Clayton Wukich* and Ines Mergel

Closing the Citizen-Government Communication Gap: Content, Audience, and Network Analysis of Government Tweets

DOI 10.1515/jhsem-2014-0074

Abstract: A key task in emergency management is the timely dissemination of information to decision makers across different scales of operations, particularly to individual citizens. Incidents over the past decade highlight communication gaps between government and constituents that have led to suboptimal outcomes. Social media can provide valuable tools to reduce those gaps. This article contributes to the existing literature on social media use by empirically demonstrating how and to what extent state-level emergency management agencies employ social media to increase public participation and promote behavioral changes intended to reduce household and community risk. Research to this point has empirically examined only response and recovery phases related to this process. This article addresses each phase of emergency management through the analysis of Twitter messages posted over a 3-month period. Our research demonstrates that while most messages conformed to traditional one-to-many government communication tactics, a number of agencies employed interactive approaches including one-to-one and many-to-many strategies.

Keywords: emergency management communication; social convergence; social network analysis; twitter.

1 Introduction

The inability of government actors, whether local, state, or federal, to generate adequate risk perception among the public and to disseminate timely

***Corresponding author: Clayton Wukich**, Department of Political Science, Sam Houston State University, 1901 Avenue I, Rm 496D, Huntsville, TX 77341, USA, e-mail: wukich@shsu.edu
Ines Mergel: Department of Public Administration and International Affairs, Maxwell School of Citizenship and Public Affairs, Syracuse University, 215 Eggers Hall, Syracuse, NY 13244, USA

protective action information represents an ongoing set of problems in emergency management. What is also important to note is that government performance declines when agencies fail to receive adequate feedback from constituents about an incident and related community needs. These problems create communication gaps – or information asymmetries – in which valuable information exists but is denied to certain actors. The results can be devastating, particularly in cases where lives and community infrastructure are at risk. Social media including networking sites such as Facebook and microblogging services such as Twitter offer platforms that government agencies can use to increase and improve communication with the public. In 2011, Craig Fugate, Administrator, Federal Emergency Management Agency (FEMA) said in a statement before the Senate Committee on Homeland Security and Governmental Affairs, Subcommittee on Disaster Recovery and Intergovernmental Affairs that:

Social media provides the tools needed to minimize the communication gap and participate effectively in an active, ongoing dialogue. It helps to facilitate the vital two-way communication between emergency management agencies and the public, and it allows us to quickly and specifically share information with state and local governments as well as the public (Fugate 2011).

Despite the recognized utility of incorporating social media into existing communication strategies, challenges still exist in terms of implementing effective practices. For example, although state and local governments employed social media leading up to and during Hurricane Sandy, many citizens either ignored or missed these official warnings and instead turned to third parties such as utility companies, Google, or the Red Cross for life-saving information. Citizens also paid attention to their friendship networks on social media more than they did to government information (Ambinder et al. 2013; Committee on Homeland Security 2013). Government at all levels clearly must adjust to new methods of communication in order to connect with citizens online. While there is much social media activity among agencies across different policy domains, it is still a mechanism that is mostly used as an announcement system to push information out to the public, and rarely can we observe direct interactions with citizens (Mergel 2011, 2013). While case study research in emergency management has illustrated strategies developed by early adopters and innovators, particularly during response and recovery operations (Hughes and Palen 2012; Sutton et al. 2014), less is known about how agencies use social media to engage and empower citizens across all phases of emergency management and across different geographic regions. In this article, we examine how and to what extent state-level emergency management agencies use social media to disseminate information and engage constituents in conversations and coordinated action across the different phases of emergency management.

We first review the existing literature on social media use and public participation, including the interactions between government and citizens during disaster response operations. We then provide empirical evidence using Twitter data of emergency management agencies from 48 US states as well as the District of Columbia, illustrating online tactics emergency managers apply when communicating with citizens.¹ This article contributes to the existing literature on social media use by empirically demonstrating how and to what extent state-level emergency management agencies employ social media to increase public participation and promote behavioral changes intended to reduce household and community risk, not just during response and recovery operations, but by encompassing all phases of emergency management. We employ a communication framework in presenting our results to illustrate the options available to facilitate government-citizen interaction (e.g. one-to-many, one-to-one, and many-to-many communication strategies). While we observe limited direct interaction between agencies and citizens via Twitter, we identify an array of message types intended to communicate risk, engage citizens in conversations, and promote behavioral changes related to risk reduction.

2 Social Media Communication between Government Agencies and Citizens

2.1 Modes of Civic Engagement

A variety of approaches are available to government agencies to communicate with and include citizens in the governing process (Gastil 2008; Nabatchi 2012). These approaches provide options for government agencies using social media applications such as the microblogging site Twitter or the social networking site Facebook. These options, or modes of citizen engagement, include 1) traditional one-to-many communication strategies; 2) one-to-one strategies in which two-way channels are created; and 3) many-to-many strategies in which public conversations take place between multiple participants.

One-to-many strategies represent a common approach in communicating with the public (Gastil 2008). Previous research has shown that government agencies rely on social media as additional e-Government channels to recycle

¹ State-level emergency management agencies in Pennsylvania and Idaho have not yet adopted official Twitter accounts.

content in a press-release style format, employing mostly one-to-many push tactics in order to inform and educate the public (Mergel 2012, 2013). The same research identified little evidence of agencies directly responding to individual citizen inquiries one-to-one (Mergel 2012, 2013). Furthermore, agencies across different policy domains and levels of government generally have not employed social media channels for deliberative, many-to-many communication purposes such as collaboratively creating public policy or for other shared purposes with an unknown outcome (Nabatchi 2012).

The lack of one-to-one and many-to-many communication strategies is potentially problematic because government's online presence on social networking sites where many citizens regularly interact with friends, with brands or with the general public, results in an expectation of an omnipresent availability of government organizations in the same way that citizens experience interactions with other online actors (e.g. Zavattaro and Sementelli 2014). Again, government at all levels must adjust to new methods of communication in order to connect with citizens online.

2.2 Social Media Communication in Emergency Management

Social media use in emergency management has demonstrated considerable potential in disseminating information and encouraging public participation, particularly during response and recovery operations. Sutton et al. (2013a), for example, demonstrated how social media were used during the 2010 BP oil spill to facilitate interagency communication between state and federal agencies. An analysis of tweets posted during the 2011 Queensland floods illustrated the value of social media to serve as a forum for citizens to share information with public officials (Bruns et al. 2012). Heverin and Zach (2012) documented the social support function social media fills during and after disasters, using tweets to show how messages were first used to share information and later on to share opinions. Both types of messages helped people to make sense of the multiple campus shootings on US college campuses. Bennett (2014) observed one local agency's social media activity following a tornado in Oklahoma and noted that almost a fifth of their posts consisted of direct contact with constituents often linking them with needed information and resources.

What these example show is the potential for new forms of public participation. Government agencies can now quickly disseminate protective action information to large audiences, collaborate more effectively across agencies to share information, and allow the public to contribute mission-relevant information.

Social media provide mechanisms to manage the convergence of multiple actors during a disaster, especially citizens.

3 Social Convergence of Government-Citizen Interactions during Disasters

3.1 From Physical to Online Convergence

During disasters, different types of people have long converged on the scene; some to help, some to watch, and others to exploit the circumstance for their own gain (Tierney and Quarantelli 1989; Kendra and Wachtendorf 2003). Social media now offer digital platforms on which these actors and their updates can converge. Government can take advantage of these platforms to more effectively communicate and coordinate collective action (Wukich forthcoming). Coupled with first responders, donor agencies, and other officials, disasters become crowded mixes of people, some of whom demonstrate conflicting goals and interests (Tierney and Quarantelli 1989; Tierney et al. 2001). Researchers have illustrated several challenges in communicating with and coordinating these multi-actor networks and have recommended the use of information and communication technology to organize activities (Comfort 2005; Kapucu 2006; Hu and Kapucu 2014). However, this research focuses primarily on first responders, other key agencies, and, to a lesser extent, emergent community groups, rather than on individual citizens.

Citizens are usually first on the scene; they are directly impacted by events and can serve as the *first* first responders to help each other and relay important impact information to officials (FEMA 2011). Their involvement in related information and coordination networks is critical (Drabek 2010). Social media platforms now provide forums for an array of individuals to converge and coordinate without necessarily sharing the same physical space.

In disaster situations, citizens have long turned to friends and family for social support and guidance (Lindell and Perry 2012). This process is called *information milling* and social networking sites have become trusted resources to vet information received through formal communication channels such as the Weather Channel or other media outlets reporting about a disaster (Bourque et al. 2013). Two problems, though, are that information is not shared uniformly within these social networks, thus creating information asymmetries (Southwell 2013); and the information that is shared may not be accurate (Hughes and Palen 2012).

Government organizations have the opportunity to use social media channels to move timely, unique, and unfiltered information into the networks where citizens are talking about issues and inform them about actual risk and not just the perceived risk assessed by laymen or the community as a whole (Bruns et al. 2012; Bruns 2014; Wukich and Steinberg 2014). Otherwise, false rumors can spread or people remain uninformed, and as a result, citizens may either fail to act or develop ad-hoc community structures that might even hinder official response activities. For example, some Twitter users have developed online memes and/or have spread false rumors which add to an event's confusion and uncertainty. During Hurricane Sandy, social media users distributed photoshopped images of flooded subway stations with sharks or doomsday clouds circling around the Statue of Liberty (Eveleth 2012). Dealing with social media's dark side has proven to be difficult for public managers – public information officers need to constantly monitor online interactions, understand the emerging hashtags, and move correct information into the network when they see false rumors being picked up and replicated (Hughes and Palen 2012).

While not all social media information is tainted by memes, it is important to separate the signal from the noise, to support the actors involved in social convergence following a disaster, and to connect them to the right resources (Hughes et al. 2014). Then it is possible to converge on the right information, reach the right audiences when they need it, and move people and organizations toward or away from response operations as needed. Past research, however, indicates limited government participation in these online conversations which was discussed by Sutton (2010) and Wukich and Steinberg (2014) for example.

3.2 Information Monitoring and Exchange

Government agencies at various levels already disseminate information online with messaging that conveys a range of intentions (Bruns et al. 2012; Heverin and Zach 2012). Emergency managers can engage citizens using various social media functions such as replies, mentions, or hashtags to generate increased interaction and to encourage citizens to retweet key messages (Sutton et al. 2014). Existing research, however, points to the fact that most online communication occurs in the form of one-way dissemination of protective action information from agencies to citizens as extension of previous public information officer functions (Sutton et al. 2013b). Regardless, there is immense potential in the use of social media to promote citizen engagement, not just during and immediately following disasters, but also to educate the public about impending risks and to disseminate strategies on how to reduce risks.

Monitoring social media data and engaging citizens in dialogue represent core functions that facilitate citizen engagement. However, both require organizational resources and in some cases policy shifts to facilitate implementation (Hughes and Palen 2012). Monitoring social media can generate valuable situational awareness and actionable intelligence for emergency managers as well as encourage conversations with constituents (Sutton 2009; Hughes et al. 2014). This type of work can be done manually or with the aid of search and sorting technologies used to identify problems and needs (Latonero and Shklovski 2011).

Through monitoring, decision makers become more informed. The US Geological Service, for example, uses citizen-generated impact statements posted to Twitter as data points for their own scientific analysis in order to better understand how to direct response (Wald et al. 2006; Atkinson and Wald 2007). Additionally, during the 2011 English riots, the Greater Manchester Police scanned social media to gain situational awareness and then tailored messages in order to decrease the distance between the police and the involved parties (Denef et al. 2013).

This work requires personnel, time, and resources. In order to build additional capacity, emergency managers have developed virtual operations support teams which include trusted and trained volunteers who monitor social media data and disseminate relevant information (St. Denis et al. 2012). These innovations, though, require organizational policy shifts. As citizen use of social media increases, so too does the expectation that certain public services will be available via those platforms. During emergencies, for example, people increasingly contact public safety officials via social media channels as opposed to traditional 911 calls. This requires organizations to shift policies and dedicate resources to social media monitoring whereas in the past, resources were not needed (Hughes et al. 2014).

Some agencies are experimenting with crowdsourcing initiatives during extreme events. Haddow and Haddow (2014) defined crowdsourcing in this context as “making an open call to the public asking for solutions to a problem” and allocating manageable tasks to the public. Mergel (2012: p. 264) pointed out that this involves “outsourcing tasks to a relatively large group of people, each of whom contributes to the end result.” St. Denis et al. (2014) described an incident management team in Colorado that requested photos and videos during flood response operations in order to conduct damage assessments. Other crowdsourcing tasks include fundraising, volunteer mobilization, and other types of resource seeking (Hughes et al. 2014).

Not all citizen engagement activities take place during response to disasters. We examined all phases of emergency management, including prevention, mitigation, and preparedness by asking the question: How and to what extent

do state-level emergency management agencies use social media to disseminate information and engage constituents in conversations and coordinated action across the phases of emergency management?

4 Methods

4.1 Data Collection

Twitter, the online social networking and microblogging site, provided data to examine the risk-related messages generated online between state-level emergency management agencies and citizens. Social network and microblogging sites such as Twitter facilitate the rapid transmission of information across multiple scales of action (i.e. individuals and organizations who represent different geographic regions, social sectors, and/or levels of government) (Bruns et al. 2012; Sutton et al. 2014). This is particularly useful in disaster situations since the quick dissemination of protective action information can mean the difference between life and death (Comfort 1999; Lindell and Perry 2012). In the United States, Twitter has 62.3 million users including not only millions of private citizens, but also representatives from government agencies, the news media, for-profit companies, and nonprofit organizations. Because of its diverse and extensive membership, Twitter as a platform can serve as a basis to close information gaps and support coordinated efforts to reduce risk (Bruns 2014; Wukich and Steinberg 2014).

The state is an appropriate level of analysis because agencies have more available personnel and resources to develop and implement social media policy than local governments. At the state level, survey results of Su et al. (2013), for example, illustrate a much higher rate of adoption and demonstrate more multi-dimensional use strategies than at the local level.

We analyzed all state emergency management agency messages posted during August, September, and October 2013. Our sample includes message content related to both natural and manmade incidents ranging from large-scale to relatively routine emergencies. Three incidents of particular significance provide data on higher profile response activities. These incidents include the Colorado floods (September); the Navy Yard Shootings (September) in Washington, DC; and blizzards in South Dakota and North Dakota (October), which severely impacted built infrastructure and destroyed a high number of livestock.

Previous studies have focused only on the disaster response and recovery phases of operations (Heverin and Zach 2012; Sutton et al. 2013a,b; Wukich and Steinberg 2014). Our sample includes other phases of emergency management

including prevention, mitigation, and preparedness in addition to general governance activities.² The data, therefore, offer a more complete picture of how agencies employ social media to connect with citizens.

Nationally-organized efforts to raise awareness of hazards and increase citizen preparedness levels occurred during this period and offered opportunities to examine whether state agencies engaged in a coordinated dialogue with their citizens during that timeframe. Notable national initiatives included the National Preparedness Month (September), the Great American ShakeOut earthquake drill (October), and National Cyber Security Awareness Month (October).

To facilitate our data collection process, we first identified official Twitter accounts by reviewing agency websites to detect advertised social media accounts. This approach reduced the risk of selecting unofficial accounts and conformed to previous approaches to enumerate official accounts (see Sutton et al. 2014). We observed that 48 of 50 state agencies held accounts with the exception of Pennsylvania and Idaho.³ Colorado, Delaware, and Missouri advertised two accounts each and by including the District of Columbia, we identified 52 official Twitter accounts.

Twitter makes users' messages publicly available through their application programming interface (API). Using a program designed by our research team to scrape Twitter's API, we collected 8671 time and date-stamped messages—all messages posted during our period of observation. For each message, we collected the text itself and determined whether the posting was a reply to a previous message. For replies, we also collected the account name for each user to whom the reply was directed. That data then provided the basis for our network analysis.

4.2 Data Analysis and Methods

Our intent was to examine how and to what extent government agencies reached out to and generated a dialogue with private citizens via Twitter. We first analyzed a total of 8671 tweets), assigning attributes based on message type. We then enumerated and analyzed specific one-to-one interactions.

² These phases of prevention, mitigation and preparedness, response, and recovery, correspond with the life cycle model of emergency management (see Phillips et al. 2012). Messages regarding the prevention of an incident are labeled "prevention." Messages related to physical damage or impact reduction are labeled "mitigation." Preparedness messages pertain to planning and readying for disasters. Response messages relate to actions taken during the onset and duration of an incident. And recovery messages pertain to actions taken following an incident intended to support minimum operating standards and/or bring a community back to normal.

³ Additional Google and Twitter searches confirmed that Pennsylvania and Idaho possessed no accounts.

We first sought to better understand how and to what extent agencies crafted and directed message content for private citizens as opposed to other organizations and the news media. In order to do this, we coded all 8671 tweets. Message types from previous research on warning and advisory messages (Sutton et al. 2014) as well as other strategies and tactics (Wukich forthcoming) were adopted as a template to code message data. Using these examples, we conducted a content analysis of messages and manually assigned whether messages communicated advice and guidance, crowdsourcing requests, or used other tactics to engage citizens in a dialogue regarding risk reduction (see appendix for coding categories). Not all message types were mutually exclusive; therefore, messages representing multiple types were coded accordingly. We also identified the disaster phase and the relevant hazard type to which each message applied. Descriptive statistics in the form of frequency distributions and cross tabulations provide a baseline set of evidence to examine the phenomenon in question. We used the statistics package SPSS (IBM Corp. 2013) to facilitate our analysis.

To examine one-to-one interactions, we selected only the reply-to messages for the analysis (a total of 468 tweets). In our dataset, actor attributes were not automatically assigned and not all users were private citizens; therefore, we manually distinguished citizens from other actor types by assigning users according to demonstrable specific attributes. This attribute data then facilitated our audience analysis. We assigned each user appearing in the network one of the following actor types: government, private citizen, news media representative, nonprofit organization, or for-profit organization. This taxonomy conforms to previous research (see Wukich and Steinberg 2014). Twitter user descriptions and websites provided necessary information to determine actor affiliation. Relationship and actor attribute data then facilitated our network homophily analysis which enabled us to identify the extent to which state agencies interacted directly with private citizens as well as other groups. We used the social network analysis software package UCINET (Borgatti et al. 2002), specifically because of their homophily analysis function.

5 Results

Over our 3-month period of observation, state-level emergency management agencies tweeted a total of 8671 messages across the United States. The vast majority of all tweets (8181 or 94.3 percent) were one-to-many messages. Of these, 4672 messages were directed not to other agencies or the news media, but specifi-

Table 1: Frequency of Messages Generally Directed to Citizens.

Advice and guidance	656
Drill-related	448
Education-related	2764
Gamification	175
Information gathering	270
Intelligence gathering	40
Resource seeking	297
Rumor management	22
Total	4672

cally to citizens.⁴ Table 1 illustrates the frequency of messages generally directed to private citizens. Agencies designed these messages to either inform citizens regarding risk reduction strategies or involve them through volunteering or other types of direct participation. For example, education-related tweets intended to increase citizen preparedness levels constituted 31.9 percent of all messages. Other messages related to agency news, operations, commentary, and other types not necessarily designed to engage citizens.

Not all of these one-to-many messages represented traditional push strategies. Many agencies sought citizen participation by posing questions and organizing contests. Agencies also promoted participation during response and recovery efforts by recruiting volunteers, raising funds, and seeking out intelligence and other resources. This provides evidence that emergency management agencies promoted citizen engagement, and it also provides the basis for the limited amount of one-to-one communication that took place.

Of the 8671 total messages, 5.4 percent were one-to-one communications (468). Of those, however, only 27.1 percent were directed to private citizens; only 15 states engaged citizens in this manner. We reported the frequency of these messages across different phases of emergency management and identified specific examples to illustrate the interactions.

To a much lesser extent, agencies demonstrated a many-to-many strategy by disseminating rumor management messages, which indicates that personnel monitored social media feeds and actively sought to clarify misinformation about an incident. This type of message represents an example of a many-to-many

⁴ Not all messages types were directed to private citizens. Many such as hazard impact statements shared operational intelligence and were directed to other agencies. Other message types focused on administrative activities and were intended for a wide audience, including other agencies and the news media.

communication practice in which content is generated and altered by several actors in an ongoing manner.

Our observations suggest that several agencies monitored social media to better understand citizens' perceptions of risks and used Twitter specifically to encourage and coordinate risk reduction efforts; furthermore, we identified a number of agencies that actively responded to their constituents' information milling activities and encouraged further dialogue. The following sections illustrate those practices and examine the extent to which they were implemented. We observed that several agencies engaged in advanced dialogue building, thus providing specific engagement practices available for adoption across different levels of government. These efforts are organized by three types of communication practices: one-to-many, one-to-one, and many-to-many approaches.

5.1 One-to-Many Communication

The vast majority of messages – 8181 (94.3 percent) – were tweets directed not to just one individual, but to larger audiences including other agencies, nonprofits, and news media. We identified 4672 messages directed toward private citizens in general. Several message types such as education-related, information gathering, advice and guidance, and crowdsourcing messages were designed to promote risk reduction behaviors or at least to generate related dialogue. Some message types such as information gathering and crowdsourcing-related tweets were posted in attempts to coordinate various forms of collective action. Agencies did not relegate these messages to disaster response operations only, but to all phases of emergency management. In fact, the frequency of messages intended to engage the public in dialogue increased during non-response phases. The next section examines message types most used during prevention, protection, and preparedness activities, followed by a section that examines messages used during response and recovery operations.

5.1.1 Prevention, Protection, and Preparedness Messages

5.1.1.1 Education-related Messages

The most frequently observed message type out of all the messages were education-related tweets (31.9 percent). These messages instructed community members on how to improve their household-level and workplace preparedness prior to an extreme event. They also coached individuals on how to implement various prevention or mitigation strategies. During the period of observation,

every agency with the exception of Oklahoma and Alaska tweeted at least one education-related message; the most active states were Michigan (280), Delaware (252), and Washington State (245). Michigan Emergency Management and Homeland Security tweeted in September “Create a family emergency plan so that you know what to do, where to go & how to communicate with your family during a disaster. #NATLPREP.” This message is consistent with a large number of general preparedness tweets.

Table 2 demonstrates the frequency distribution of education-related messages by emergency management phase. Most messages pertained to preparedness (83.1 percent); however, messages also addressed prevention and protection topics such as crime and house fire prevention and cyber security (13.8 percent) as well as earthquake and wildland fire mitigation practices (1.8 percent).

Table 2 indicates that some agencies disseminated education messages during response and recovery operations as well. These messages generally encouraged constituents to garner lessons from current events and prepare for future incidents.

Many state agencies increased their use of education-related tweets during the month of September, which was also National Preparedness Month, an effort sponsored by FEMA. A total of 1216 messages (44.0 percent) were disseminated in September as opposed to 887 (32.1 percent) in October and 551 (23.9 percent) in August. Much of the September message content was similar across states, which may indicate that FEMA distributed talking points and/or agencies shared and retweeted ideas.

5.1.1.2 Drills

A related message type was intended to coordinate collective action in the form of preparedness drills in which people practiced what to do in the event of a disaster. Many agencies in particular devoted time and effort to organize earthquake

Table 2: Frequency of Education-Related Messages by Emergency Management Phase.

	<i>n</i>	%
Prevention/protection	381	13.8
Mitigation	49	1.8
Preparedness	2296	83.1
Response	32	1.2
Recovery	3	0.1
Not applicable	3	0.1
Total	2764	100

drills. Twenty-nine states coordinated the events as part of the Great ShakeOut Earthquake Drills in October. Agencies used messages to both educate constituents on what to do during an earthquake – such as drop, cover, and hold – and also to promote participation in the event. The Missouri State Emergency Management Agency tweeted “Will You Drop, Cover, Hold On? Video spreads the word about #MO’s ShakeOut earthquake drill on Oct. 17 at 10:17 AM: <http://t.co/ODmCkeJcJ>.” Like the education-related tweets during National Preparedness Month, messages promoting these drills increased sharply as a result of the ShakeOut; 332 of the 448 related messages (74.1 percent) were posted leading up to and immediately following the ShakeOut in October.⁵

5.1.1.3 Gamification

Some agencies used the ShakeOut event as an additional opportunity to generate dialogue with constituents. Oregon Emergency Management, for example, created a game out of the event, tweeting “Get read to Drop! Cover! Hold! with over 260,000 #OregonShakeOut win prizes #ShakeOutSelfie @RedCrossPDX <http://t.co/WNKD7Hlyb4>.” In this case, the agency incentivized participation by offering prizes. This online practice of gamification was employed in other instances. Twenty-six agencies reached out to constituents through games and contests with the goal of promoting community and household preparedness across a number of different types of hazards. Arizona led the way with 37 related messages followed by Alabama (20), Georgia (19), and Maryland (11).

Some of the games were developed by the Clark Regional Emergency Services Agency in Washington State as part of their disaster preparedness game *30 Days, 30 Ways*. Here agencies post preparedness activities each day and ask the public to complete a task. They then post creative photos and descriptions relevant to that day’s theme. Winners are chosen by agency personnel and given various prizes. Another game, *The Emergency Kit Cook-Off*, was created by the Arizona Division of Emergency Management and implemented across the country. It asks constituents for their best recipe using the types of nonperishable food items that one would find in a household disaster kit. Maryland, for example, used the following Tweet to promote the contest: “Calling all chefs! Do you have what it takes to submit this year’s winning #KitCookOff #recipe? Learn more: <http://t.co/PRyfXrw5ch>.”

⁵ On a related note, another national preparedness effort which occurred in October, the National Cyber Security Month, appears to have also generated results. Of the 346 total cyber security-related messages in our dataset, 312 (90.2 percent) occurred in October.

5.1.1.4 Information Gathering

During ShakeOut promotions and other activities, games and contests were not the only tactic employed to generate dialogue with constituents. Maryland, for example, posted “Tweet us your pictures of your office participating in the Great SouthEast #ShakeOut today at 10:17 a.m.! <http://t.co/8OHFpCJOo8>.” California tweeted “If you were in a #ShakeOut drill today, tell us where!” This type of information gathering occurred throughout our period of observation with agencies requesting information to stimulate dialogue with constituents by asking questions and encouraging constituents to reply with photos, videos, opinions, or other pieces of information. Other messages invited constituents to participate in public Twitter chats using various hashtag topics.

Several agencies (35) employed information gathering tweets for a total of 270 messages. Maryland (58 messages) and Washington State (50 messages), in particular, demonstrated a consistent commitment to generating this type of conversation. For several weeks, the Maryland PIO invited constituents to share stories about how they had prepared for disasters and how being prepared in the past had benefited their families. One of the many tweets read “How prepared are you for the next disaster? Tell us all about it by sharing your story at mdprepares@gmail.com. #MDPrepares.” The PIO then shared those stories publicly to promote National Preparedness Month and thus helped to generate a dialogue with constituents regarding preparedness.

5.1.2 Response and Recovery Messages

Over the 3-month period of observation, two large-scale natural disasters occurred, flooding in Colorado (September) and blizzards in the Dakotas (October). Many other incidents occurred throughout the country including tropical storms, tornadoes, wildfires, thunderstorms, and a shooting at the Navy Yard in Washington, DC. As part of response and recovery operations, agencies employed several message types to empower constituents with protective action information and to engage them in emergency management operations. Message types included advice and guidance, rumor management, intelligence gathering, and resource seeking such as volunteer recruitment and fundraising.

5.1.2.1 Advice and Guidance

Before, during, and in the immediate aftermath of an incident, many agencies disseminated advisory information which represented instructions or suggestions to the public regarding what protective actions to take. This message type was

in addition to warnings and watches which alerted the public to specific threats of danger. A total of 656 advice messages were disseminated; 321 (48.9 percent) came from Colorado as a result of the September flooding. Colorado posted original content but also retweeted messages from the National Weather Service and many local governments to amplify important advisory posts. For example, on September 12 as flashflood conditions materialized, the PIO retweeted advice from the City of Fort Collins: “Monitor local #rainfall & streamflow at <http://t.co/8zExaillGV>.” The PIO urged Coloradans to “avoid driving through floodwaters...” Additional evacuation orders and recommendations followed from across the state. The agency disseminated protective action information to citizens throughout the incident and into recovery operations as well, ranging from public health to fraud awareness messages.

South Dakota Emergency Management posted 16 advice and guidance messages during the catastrophic winter storm in October. One message read, “Snow continues to fall and strong winds continue to create white-out conditions. So DOT & DPS officials say, ‘Please Stay Put Today.’ #sdwx>” The PIO tweeted and retweeted several other messages which also urged constituents to shelter in place. Official guidance continued into the recovery phase as farmers and ranchers struggled to cope with livestock loss and damaged infrastructure. South Dakota retweeted messages from other state agencies, including: “SD Ag Dept. Reminds Producers to Document Livestock Losses <http://t.co/ffdjzSE5pP> #sdag #octoberblizzard.” They also created original content intended for farmers and ranchers. “After a storm, often ranchers need the down poles moved off cattle fence. Policy is generally to let ranchers keep the pole for removing it.” This was helpful guidance for farmers struggling to rebuild.

Across the country, the suggestions and recommendations made by state agencies were intended to help the public protect themselves in the face of risk and then empower individuals, households, and communities to recover from an incident. These messages, however, represent one-way communications in which agencies push messages out to the public. Many agencies took their communications to another level by asking the public to interact with them to solve emerging problems. This type of interaction, known as crowdsourcing (see Bruns 2014; Haddow and Haddow 2014), was facilitated online through Twitter.

5.1.2.2 Crowdsourcing for Resources and Intelligence

Many agencies used Twitter to request resources from the public in the form of volunteers, money, and other donations. These efforts went beyond creating a dialogue, since government agencies requested the public’s time, effort, and

resources. They also asked the public for real-time information that enhanced the situational awareness of emergency managers.

Following the Colorado floods, Colorado requested donations and volunteers: “Looking to volunteer or to donate items to help #COFlood survivors? <http://t.co/hr2XMJCIIj> has the best info to share. #COFlood #COPrepare.” Helping to coordinate recovery efforts after a tornado, Iowa Homeland Security and Emergency Management posted “Volunteers! A tornado cleanup is scheduled for Sat. 10/26 from 9-3 in Belmond, IA. Call city hall to sign up... <http://t.co/hteU5ykwDt>.” These requests helped to recruit and organize needed volunteers.

Requests were not limited to just response and recovery operations. Table 3 illustrates that agency requests for volunteers occurred mainly during the preparedness phase (51.0 percent). Agencies sought to link people with opportunities ranging from firefighting to an array of voluntary organizations active in disasters. These messages quite often informed constituents of the mission of the organization and then solicited volunteers. The Nevada Division of Emergency Management and Homeland Security, for example, tweeted that the “Medical Reserve Corps program offers help to medical, public health & volunteers during local emergencies/year-round. <http://t.co/OAWuvt8ZQR>.”

While a large portion of volunteer recruitment occurred during the preparedness phase, the vast majority of fundraising (92.5 percent) and requests for other types of resources (88.9 percent) took place during response and recovery operations.

Another type of crowdsourcing was intelligence gathering. During our period of observation, 21 agencies asked the public for information to increase

Table 3: Crowdsourcing for Volunteers, Donations, and Other Resources.

	Volunteers		Fundraising		Other Resources		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Prevention/protection	2	2.0	–	–	–	–	2	1.2
Mitigation	–	–	–	–	–	–	–	–
Preparedness	51	51.0	3	7.5	3	11.1	57	34.1
Response	25	25.0	21	52.5	14	51.9	60	35.9
Recovery	20	20.0	16	40.0	10	37.0	46	27.5
Not applicable ^a	2	2.0	–	–	–	–	2	1.2
Total	100	59.9	40	24	27	16.2	167	100

^aTwo volunteer recruitment solicitations were retweeted messages from other agencies. For example, Nevada retweeted a Bureau of Land Management request: “BLM seeks volunteers for clean-up and fossil hunt for National Public Lands DayELKO, Nev. –The Bureau of Land... <http://t.co/Q0KJPFplfF>.”

their personnel’s situational awareness about an incident. After an earthquake, Wyoming sought confirmation and public experiences asking “Did any of you feel the 4.9 earthquake 12 miles west of Fort Washakie? It happened just a little after 7 a.m.... <http://t.co/AnELc0BmsT>.” Virginia retweeted a request from the Washington, DC police after the Navy Yard Shooting in September: “Any Navy Yard suspect info please call 1800-CALL-FBI.” These types of messages sought public information to gain a better understanding of an incident and how to proceed operationally. While only 40 requests were made across the country during our period of observation, the fact that 21 agencies employed this tactic indicates that a sizable portion of state-level emergency management agencies value this type of information and are inclined to use social media platforms to request it.

5.2 One-to-One Communication

Twitter allows users to disseminate messages to large audiences, but also allows users to direct messages to specific accounts. Users can then reply to directed messages; this creates the foundation for an information exchange network and the basis for online government-citizen relationships. In our data, reply messages constituted 5.4 percent of total tweets (468), of which 27.1 percent (127 messages) were directed to private citizens. Table 4 illustrates the frequency of messages by user type broken down by private citizens, the news media, nonprofit organizations, government agencies, and for-profit organizations.

In addition, Table 4 reports the results of our audience analysis using homophily measures, indicating the number of unique actors with whom agencies interacted. The distribution of messages across a variety of actor types suggests that emergency management agencies had several audiences. Agencies sought out information exchange from multiple actors, including other government agencies, nonprofits,

Table 4: Frequency of Messages and Actors by Type of Actor.

	Messages		Individual Actors	
	<i>n</i>	%	<i>n</i>	%
Private citizens	127	27.1	95	34.7
Media	42	9.0	27	9.6
Nonprofits	44	9.4	23	8.4
Government	246	52.6	121	44.2
Commercial	9	1.9	8	2.9
Total	468	100	274	100

the news media, and private citizens. For example, the government agencies and nonprofits charged with emergency management responsibilities shared information with each other; the majority of messages to which state level emergency management agencies replied (52.6 percent) originated from other government agencies. Another 9.4 percent originated from nonprofits. State agencies also interacted with news media outlets (9.0 percent of total messages), which represents the continuation of established public information officer-media relationship.

Through Twitter, private citizens can directly contact state agencies. The observation that private citizens constitute a relatively large portion of overall actors (34.7 percent) as well as message replies (27.1 percent) suggests that at least some agencies worked to create a two-way dialogue with constituents, whether agencies encouraged this interaction beforehand or simply responded to unsolicited messages.

The limited number of overall private citizens with whom agencies interact (95), however, indicates the state government-citizen relationship is not vast. Furthermore, the practice is not equally adopted throughout the country. Only 20 states and the District of Columbia replied to any messages at all and only 15 states replied to messages from private citizens, including Maryland (37), Colorado (24), South Carolina (13), Hawaii (11), and Utah (9).

Message topics between government agencies and citizens varied. Table 5 illustrates the frequency distribution of messages related to emergency management phases.

During our period of observation, exchanges between state agencies and private citizens generally had to do with either preparedness activities (42.5 percent) or response operations (32.3 percent).

Table 5: Frequency of Reply Messages to Citizens by Emergency Management Phase.

	Private Citizens		Total	
	<i>n</i>	%	<i>n</i>	%
Prevention/protection	–	–	5	1.1
Mitigation	–	–	2	0.4
Preparedness	54	42.5	137	29.3
Response	41	32.3	191	40.8
Recovery	6	4.7	81	17.3
Not applicable ^a	26	20.5	52	11.1
Total	127	100.0	468	100.0

^aA sizable portion of messages labeled under the category “Not applicable” in Table 2 pertains to either short pleasantries or administrative-related notes not necessarily relevant to the emergency management cycle.

5.2.1 Preparedness Tweets

The plurality of replies pertained to preparedness activities (42.5 percent). Most of these messages praised constituents for work they had already completed and/or suggested strategies to further prepare for specific hazards. For example, the California Governor's Office of Emergency Services on September 30 posted a message about household disaster kits and then replied to several constituents who responded. "Great job for replacing your emergency food supplies!" the public information officer (PIO) replied to one constituent, "Do you have only canned items or boxed items as well?" By posing an additional question, the PIO both suggested another useful supply and encouraged further dialogue.

Some messages replied to criticism. During an October rollout of the Maryland Emergency Management Agency's new preparedness mobile app, one private citizen criticized its functionality. Instead of ignoring the message, the PIO sought feedback, "What in particular about the app do you feel could be improved (graphics, content, features)? We appreciate your feedback." In an October 4 reply to a separate constituent's complaint, California posted "Sorry you did not like our Tweet. Yes, we do provide emergency information besides other #hottopics. What would you like to see?" In both cases, agencies engaged users directly and encouraged additional dialogue.

5.2.2 Response Tweets

Notable interactions between agencies and citizens occurred during response operations. At the onset of the September 2013 floods, for example, Colorado Emergency Management received a handful of messages from constituents seeking assistance. The PIO without exception connected them to local authorities who were in a position to help. "Contact @jeffcosheriffco for assistance or contact me by DM," the PIO advised one Jefferson county resident. Not every citizen made a specific request or provided details such as location; some would simply ask for help. The PIO often requested more information: "I need more info to direct you to the right info line," she replied to a constituent, "Direct message me [your] specific location." Those types of exchanges occurred in other states—the Georgia Emergency Management Agency replied to a vague request received during severe flooding by asking "What county are you in? Do you need help?"

Even in non-disaster situations, state agencies used Twitter to inform the public in the midst of uncertainty. In Hawaii on September 13, tsunami sirens accidentally sounded, which raised the concerns of citizens. Several people contacted Hawaii Civil Defense via Twitter to validate the warning. The agency used

several reply messages to communicate that the siren had misfired. First, the PIO publicly replied to a resident “No emergency. More details to follow.” Then the PIO further clarified the situation, “No emergency, seems to be a runaway siren.” Finally, the PIO apologized and offered more information, “Sorry for the disturbance. City and County is going to manually deactivate the siren.” Through social media, the agency interacted in real time with constituents to offer information as opposed to depending on intermediaries such as the news media, a strategy that might have missed some people who were reached by Twitter. This example is one in which the PIO undoubtedly had time and resources to investigate the problem and engage in an extended one-to-one dialogue with constituents. As the intensity of an incident increases, resource strapped agencies may not have the time and resources to engage in one-to-one communication.

5.3 Many-to-Many Communication

5.3.1 Rumor Management

By monitoring social media feeds and other sources, some agencies (12) identified false rumors and incorrect information and disseminated clarifications, although only 22 such messages were posted. The process through which these messages developed represents a many-to-many communication dynamic. Most rumor management messages concerned response (7) and recovery (7) operations. Colorado disseminated eight messages following the floods, many regarding conmen who canvassed communities soliciting residents for fraudulent fees in exchange for promised government services. In response, Colorado posted messages such as this, “All #FEMA housing inspectors have photo ID badges. There’s no fee for the inspection. FEMA Disaster Fraud Hotline at 866-720-5721. #COFlood.” In another case, the New Jersey Office of Emergency Management refuted widespread reports of a tornado. “Rumor Control: Despite media reports, NO tornado touchdown in Butler, Morris Co. last night. Info confirmed by NWS. Possible microburst.” To post a rumor management message, agencies first must recognize false information circulating among the public and then take steps to correct it. This again is an example of a many-to-many communication approach.

6 Discussion and Conclusion

Our analysis indicates that a number of emergency management agencies not only recognize the importance of interactive communication practices between

themselves and their constituents, but are actually implementing strategies to engender such dialogue about risk and coordinated risk reduction. Toward those ends, the vast majority of agencies disseminated advice and education-related messages specifically directed to constituents with the goal of inducing behavioral changes in support of emergency management needs. However, most agencies failed to demonstrate direct, one-to-one interaction with constituents. In addition, most agencies did not explicitly participate in many-to-many forms of communication, though, many consistently attempted to engage constituents in a dialogue related to risk reduction.

Our findings offer three contributions to the existing literature and offer lessons for practicing emergency managers. First, a sizable portion of agency activity was dedicated to prevention, mitigation, and preparedness topics. Education-related tweets, for example, instructed citizens on how to improve their household-level and workplace preparedness prior to an extreme event. These findings provide empirical evidence indicating that agencies spend considerable time and effort on preparedness, thus contributing to the existing literature focused on response and recovery (Bruns et al. 2012; Sutton et al. 2013b). This finding also suggests that emergency managers should not wait until a disaster to start communicating with their constituents. Instead, practitioners should identify diverse audiences early and work to build a trusted online community that perceives updates as valuable and is willing to share their updates within their own networks.

Second, agencies employed one-to-many strategies to both push information to the public but also to request public feedback. We observed this type of behavior during response operations in the form of crowdsourcing for volunteers, donations, and intelligence. Agencies demonstrated an even higher frequency of dialogue building during the preparedness phase in the form of gamification messages and other information gathering tactics, which could provide the impetus for more public, deliberative communications processes (see Gastil 2008). Maryland and Washington State deliberately and consistently attempted to engage constituents in dialogue regarding preparedness. This suggests that the one-to-many mode of citizen engagement can be used to promote many-to-one communications or, with the use of hashtags and other grouping mechanisms, a many-to-many mode. For practitioners, these best practices offer examples of proactive relationship building that ideally increase trust and transparency. This type of activity, however, requires time and resources for training and implementation. Emergency managers may want to consider developing virtual operations support teams as a surge capacity to handle increased demand for monitoring and dissemination in the event of a disaster (see St. Denis et al. 2012).

Third, agencies demonstrated some signs of many-to-many communication in the form of rumor management. This behavior, coupled with efforts to recruit

citizens in various dialogues, suggests that a number of agencies monitored their accounts and sought to engage public participation across emergency management phases to clarify situations. These findings contradict research that suggests that social media channels have not been used for deliberative communication purposes (see Nabatchi 2012), at least in the policy domain of emergency management. Participating in many-to-many conversations through the use of hashtags, while not assessed in this article, offers another strategy to engage a larger audience. Hashtag use can increase the reach of an agency and can be used to target an array of communities including historically underrepresented group to again build a larger, more diverse, and trusted online community focused on the reduction of shared risk.

In summation, we suggest that agencies develop relationships prior to extreme events to maximize government reach via social media (e.g. Mergel 2014). Trust in government communication cannot be switched on and off when needed. Instead, government agencies need to build a resilient infrastructure and gain social capital over time, slowly collect followers, friends, and likes by providing valuable information to the citizenry during all phases of the emergency management cycle. Only then will citizens *en masse* be willing to pay attention to government information, and emergency managers will be able to rely on social media channels to distribute important information to citizens.

While our findings contribute to the existing literature on government social media use, our analysis is limited on certain fronts, providing the basis for future research. Our content analysis allowed us to extrapolate what agencies disseminated, not what constituents did with those messages. The impact of those messages on citizens is not identifiable in our dataset. Did those messages actually induce behavioral changes that improved emergency management outcomes (e.g. the protection of life and property and the continuity of operations in the event of a disaster)? Follow-up interviews with emergency managers and large-scale surveys with constituents may illuminate relevant evidence. Relatedly, it is unclear if citizens paid attention to these messages and if they did, it is also unclear how constituents interpreted them. Ripberger et al. (2014) examined how certain social media-based warnings impact levels of citizen attention. This type of research carries implications on the effectiveness of social media messaging.

Additional research might compare our findings to trends at the local level. We might expect local agencies to generate more one-to-one interactions than their state counterparts because emergency response is locally organized and state level emergency managers only get involved in when requested and then serve generally in the role of resource provider to local agencies. Bennett's (2014) analysis of one Oklahoma municipality following a tornado reported that 17 percent of all messages included some type of one-to-one communication when emergency management officials directly interact with affected citizens.

Future research should build on our findings and address how agencies can effectively develop and maintain relationships with constituents. We provided a baseline assessment of 3 months. A longer, longitudinal analysis might demonstrate the extent to which agencies change and improve their messaging and whether social convergence and emergency management outcomes improve. It would also be relevant to examine the relationship between message strategies and hazard types to determine the most effective means to implement social media use.

Appendix I

Coding Categories

Advice and Guidance: “Suggestions to the public on how to respond, what actions to take, and what to refrain from doing during the disaster” (see Sutton et al. 2014, p. 775).

Rain falling across #MO means you could be affected by flooding. Remember do NOT walk or drive thru standing water. <http://t.co/Anxg0HjpYD>.

Drill-related: Promotion/coordination of citizen-focused exercise intended to increase preparedness.

Will You Drop, Cover, Hold On? Video spreads the word about #MO’s ShakeOut earthquake drill on Oct. 17 at 10:17 AM: <http://t.co/ODmCkeJcJ>.

Education-related: Instructions on how to improve preparedness levels or implement prevention/mitigation measures prior to an extreme event.

Create a family emergency plan so that you know what to do, where to go & how to communicate with your family during a disaster. #NATLPREP.

Gamification: Promotion of community and household preparedness through games and contests.

Calling all chefs! Do you have what it takes to submit this year’s winning #KitCookOff #recipe? Learn more: <http://t.co/PRyfXrw5ch>.

Information Gathering: Requests for information/dialogue with constituents not during response or recovery operations.

How prepared are you for the next disaster? Tell us all about it by sharing your story at mdprepares@gmail.com. #MDPrepares.

Intelligence Gathering: Requests for information by agency to increase situational awareness during response or recovery operations.

Did any of you feel the 4.9 earthquake 12 miles west of Fort Washakie? It happened just a little after 7 a.m.... <http://t.co/AnELc0BmsT>.

Resource Seeking: Requests for volunteers, fundraising, or other donations from agencies to citizens.

Looking to volunteer or to donate items to help #COFlood survivors? <http://t.co/hr2XMJCIIj> has the best info to share. #COFlood #COPrepares.

Rumor Management: Clarification and corrections regarding misinformation and rumors.

Rumor Control: Despite media reports, NO tornado touchdown in Butler, Morris Co. last night. Info confirmed by NWS. Possible microburst.

Appendix II

Agency*	Twitter Handle
Alaska Division of Homeland Security and Emergency Management	AlaskaDHSEM
Alabama Emergency Management Agency	AlabamaEMA
Arkansas Department of Emergency Management	AR_Emergencies
Arizona Division of Emergency Management	AzEIN
California Governor's Office of Emergency Services	Cal_OES
Colorado Division Homeland Security and Emergency Management	COEmergency
	READYColorado
Connecticut Division of Emergency Management and Homeland Security	CTDEMHS
District of Columbia Emergency Management Agency	DC_HSEMA
Delaware Emergency Management Agency	DelawareEMA
	PrepareDE
Florida Division of Emergency Management	FLSERT
Georgia Emergency Management Agency	GeorgiaEMA
Hawaii State Civil Defense	HI_CivilDefense
Iowa Homeland Security & Emergency Management Division	IowaHSEMD
Idaho Bureau of Homeland Security	No Twitter Account
Illinois Emergency Management Agency	ReadyIllinois

Agency*	Twitter Handle
Indiana Department of Homeland Security	IDHS
Kansas Division of Emergency Management	KansasEmergency
Kentucky Emergency Management	KYEMPPIO
Louisiana Office of Homeland Security & Emergency Preparedness	GOHSEP
Massachusetts Emergency Management Agency	MassEMA
Maryland Emergency Management Agency	MDMEMA
Maine Emergency Management Agency	MaineEMA
Michigan State Police, Emergency Management & Homeland Security Division	MichEMHS
Minnesota Homeland Security and Emergency Management Division	MnDPS_HSEM
Missouri Emergency Management Agency	MOShakeOut
	MoStormAware
Mississippi Emergency Management Agency	MSEMA
Montana Division of Disaster & Emergency Services	MontanaDES
North Carolina Division of Emergency Management	NCPublicSafety
North Dakota Department of Emergency Services	NDDES
Nebraska Emergency Management Agency	NEMAtweets
New Hampshire Governor's Office of Emergency Management	NH_HSEM
New Jersey Office of Emergency Management	ReadyNJ
New Mexico Department of Homeland Security and Emergency Management	NMDHSEM
Nevada Division of Emergency Management	NVEmergencyMgmt
New York State Emergency Management Office	NYSDHSES
Ohio Emergency Management Agency	Ohio_EMA
Oklahoma Department of Emergency Management	okem
Oregon Emergency Management	OregonOEM
Pennsylvania Emergency Management Agency	<i>No Twitter Account</i>
Rhode Island Emergency Management Agency	RhodeIslandEMA
South Carolina Emergency Management Division	SCEMD
South Dakota Division of Emergency Management	SDemergencyMgmt
Tennessee Emergency Management Agency	T_E_M_A
Texas Division of Emergency Management	TDEM
Utah Division of Emergency Services and Homeland Security	UtahEmergency
Virginia Department of Emergency Management	VDEM
Vermont Emergency Management Agency	vemvt
Washington Emergency Management Division	waEMD
Wisconsin Emergency Management	ReadyWisconsin
West Virginia Division of Homeland Security and Emergency Services	WVDHSEM
Wyoming Office of Homeland Security	WyOHS

*Accounts were identified in October 2013.

References

- Ambinder, E., D. M. Jennings, I. Blachman-Biatch, K. Edgemon, P. Hull and A. Taylor (2013) *The Resilient Social Network: @OccupySandy #SuperstormSandy*. Falls Church, VA: Homeland Security Studies and Analysis Institute.
- Atkinson, G. M. and D. J. Wald (2007) “‘Did You Feel It?’ Intensity Data: A Surprisingly Good Measure of Earthquake Ground Motion,” *Seismological Research Letters*, 78(3):362–368.
- Bennett, D. M. (2014) “How do Emergency Managers Use Social Media Platforms?” *Journal of Emergency Management*, 12(3):251–256.
- Borgatti, Stephen P., Martin G. Everett and Linton C. Freeman (2002) *Ucinet 6 for Windows: Software for Social Network Analysis*. Harvard: Analytic Technologies.
- Bourque, L. B., R. Regan, M. M. Kelley, M. M. Wood, M. Kano and D. S. Mileti (2013) “An Examination of the Effect of Perceived Risk on Preparedness Behavior,” *Environment and Behavior*, 45(5):615–649.
- Bruns, Axel (2014) “Crisis Communication, Social Media, and the Environment.” In: (S. Cunningham and S. Turnbull, eds.) *The Media and Communications in Australia*. Sydney, Australia: Allen & Unwin.
- Bruns, A., J. Burgess, K. Crawford and F. Shaw (2012) *#qldfloods and @QPSMedia: Crisis Communication on Twitter in the 2011 South East Queensland Floods*. Kelvin Grove, Queensland, Australia: ARC Centre of Excellence for Creative Industries & Innovation (CCI).
- Comfort, Louise K. (1999) *Shared Risk: Complex Systems in Seismic Response*. New York: Pergamon.
- Comfort, L. K. (2005) “Risk, Security, and Disaster Management,” *Annual Review of Political Science*, 8:335–356.
- Committee on Homeland Security (2013) “Emergency Mgmt 2.0: How #SocialMedia & New Tech are Transforming Preparedness, Response, & Recovery #Disasters.” *Committee on Homeland Security* Retrieved Serial No. 113-20. Available at: <http://www.gpo.gov/fdsys/pkg/CHRG-113hhrg85685/html/CHRG-113hhrg85685.htm>.
- Denef, S., P. S. Bayerl and N. Kaptein (2013) *Social Media and the Police-Tweeting Practices of British Police Forces during the August 2011 Riots*. Paper Presented at the 2013 Conference on Human Factors in Computing Systems (CHI 2013).
- Drabek, Thomas E. (2010) *The Human Side of Disaster*. Boca Raton: CRC Press.
- Eveleth, R. (2012) Hurricane Sandy: Five Ways to Spot a Fake Photograph, BBC.com, Available at: <http://www.bbc.com/future/story/20121031-how-to-spot-a-fake-sandy-photo>.
- FEMA (2011) *A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action*. Washington, DC.
- Fugate, Craig (2011) Understanding the Power of Social Media as a Communication Tool in the Aftermath of Disasters. *Senate Committee on Homeland Security and Governmental Affairs, Subcommittee on Disaster Recovery and Intergovernmental Affairs*. Available at: <https://www.dhs.gov/news/2011/05/04/written-statement-craig-fugate-administrator-federal-emergency-management-agency>.
- Gastil, J. (2008) *Political Communication and Deliberation*. Los Angeles: Sage Publications.
- Haddow, G. D. and K. Haddow (2014) *Disaster Communications in a Changing Media World*, 2nd ed. Waltham, MA: Butterworth-Heinemann.

- Heverin, T. and L. Zach (2012) "Use of Microblogging for Collective Sense-making During Violent Crises: A Study of Three Campus Shootings," *Journal of the American Society for Information Science and Technology*, 63(1):34–47.
- Hu, Q. and N. Kapucu (2014) "Information Communication Technology Utilization for Effective Emergency Management Networks," *Public Management Review*, 1–26.
- Hughes, A. L. and L. Palen (2012) "The Evolving Role of the Public Information Officer: An Examination of Social Media in Emergency Management," *Journal of Homeland Security & Emergency Management*, 9(1):1–20.
- Hughes, A. L., L. A. St. Denis, L. Palen and K. M. Anderson (2014) *Online Public Communications by Police & Fire Services during the 2012 Hurricane Sandy*. Paper Presented at the 2014 International Conference on Human Factors in Computing Systems (CHI 2014).
- IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
- Kapucu, N. (2006) "Interagency Communication Networks during Emergencies: Boundary Spanners in Multiagency Coordination," *The American Review of Public Administration*, 36(2):207–225.
- Kendra, J. and T. Wachtendorf (2003) "Reconsidering Convergence and Convergence Legitimacy in Response to the World Trade Center Disaster." In: (L. Clarke, ed.) *Terrorism and Disaster: New Threats, New Ideas* (Vol. 11). Bingley, UK: Emerald Group Publishing Limited, pp. 97–122.
- Latonero, M. and I. Shklovski (2011) "Emergency Management, Twitter, and Social Media Evangelism," *International Journal of Information Systems for Crisis Response and Management (IJISCRAM)*, 3(4):1–16.
- Lindell, Michael K. and Ronald W. Perry (2012) "The Protective Action Decision Model: Theoretical Modifications and Additional Evidence," *Risk Analysis*, 32(4):616–632.
- Mergel, I. (2011) "Government 2.0 Revisited: Social Media Strategies in the Public Sector," *PA Times*, 33(3):7–10.
- Mergel, I. (2012) *Social Media in the Public Sector: Participation, Collaboration, and Transparency in a Networked World*. San Francisco, CA: Jossey-Bass/Wiley.
- Mergel, I. (2013) "Social Media Adoption and Resulting Tactics in the U.S. Federal Government," *Government Information Quarterly*, 30(2):123–130.
- Mergel, I. (2014) *Social Media Practices in Local Emergency Management: Results from Central New York, Report*. Available at: <http://sotechem.syr.edu>.
- Nabatchi, T. (2012) "Putting the 'Public' Back in Public Values Research: Designing Participation to Identify and Respond to Values," *Public Administration Review*, 72(5):699–708.
- Phillips, B., D. M. Neal and G. Webb (2012) *Introduction to Emergency Management*. Boca Raton, FL: CRC Press.
- Ripberger, Joseph T., Hank C. Jenkins-Smith, Carol L. Silva, Deven E. Carlson and Matthew Henderson (2014) "Social Media and Severe Weather: Do Tweets Provide a Valid Indicator of Public Attention to Severe Weather Risk Communication?" *Weather, Climate, and Society*, 6(4):520–530.
- Southwell, B. G. (2013) *Social Networks and Popular Understanding of Science and Health*. Baltimore, MD: The Johns Hopkins University Press.
- St. Denis, L. A., A. L. Hughes and L. Palen (2012) *Trial by Fire: The Deployment of Trusted Digital Volunteers in the 2011 Shadow Lake Fire*. Paper Presented at the The 9th International ISCRAM Conference.
- St. Denis, L. A., L. Palen and K. M. Anderson (2014) *Mastering Social Media: An Analysis of Jefferson County's Communications during the 2013 Colorado Floods*. Information Systems for Crisis Response and Management Conference (ISCRAM 2014), State College, PA.

- Su, Yee San, Clarence Wardell III and Zoë Thorkildsen (2013) *Social Media in the Emergency Management Field: 2012 Survey Results*. Arlington, VA: CNA.
- Sutton, J. N. (2009) "Social Media Monitoring and the Democratic National Convention: New Tasks and Emergent Processes," *Journal of Homeland Security & Emergency Management*, 6(1):1–20.
- Sutton, J. N. (2010) *Twittering Tennessee: Distributed Networks and Collaboration Following a Technological Disaster*. Paper Presented at the 7th International ISCRAM Conference.
- Sutton, J., E. Spiro, C. Butts, S. Fitzhugh, B. Johnson and M. Greczek (2013a) "Tweeting the Spill: Online Informal Communications, Social Networks, and Conversational Microstructures during the Deepwater Horizon Oilspill," *International Journal of Information Systems for Crisis Response and Management (IJISCRAM)*, 5(1):58–76.
- Sutton, Jeannette, Britta Johnson, Emma Spiro, and Carter Butts (2013b) "Tweeting What Matters: Information, Advisories, and Alerts Following the Boston Marathon Events," *Online Research Highlight*. Available at: <http://heroicproject.org>.
- Sutton, J., E. Spiro, B. Johnson, S. Fitzhugh, S. Gibson and C. Butts (2014) "Warning Tweets: Serial Transmission of Messages during the Warning Phase of a Disaster Event," *Information, Communication & Society*, 17(6):765–787.
- Tierney, K. and E. L. Quarantelli (1989) "Needed Innovation in the Delivery of Emergency Medical Services in Disasters: Present and Future," *Disaster Management*, 2(2):70–76.
- Tierney, K. J., M. K. Lindell and R. W. Perry (2001) *Facing the unexpected: Disaster preparedness and response in the United States*. Washington, DC: Joseph Henry Press.
- Wald, D. J., V. Quitoriano and J. W. Dewey (2006). *USGS "Did you feel it?" Community Internet Intensity Maps: Macroseismic Data Collection via the Internet*. Paper Presented at the First European Conference on Earthquake Engineering and Seismology, Geneva, Switzerland.
- Wukich, C. (forthcoming). *Social Media Use in Emergency Management*. *Journal of Emergency Management*.
- Wukich, C. and A. Steinberg (2014) "Nonprofit and Public Sector Participation in Self-organizing Information Networks: Twitter Hashtag and Trending Topic Use during Disasters," *Risk, Hazards & Crisis in Public Policy*, 4(2):83–109.
- Zavattaro, S. M. and A. J. Sementelli (2014) "A Critical Examination of Social Media Adoption in Government: Introducing Omnipresence," *Government Information Quarterly*, 31(2):257–264.