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ICT mediated rumor beliefs and resulting user actions during a community crisis☆,☆☆

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ABSTRACT

In the context of Internet and Communications Technology (ICT), this research investigates the acceptance of hate rumor and its consequence during a community crisis situation. Extending prior rumor research for this context, we develop and test a refined model using data collected from victims of a large scale (hate) rumor spread incident. Our data analyses present three main findings. First, during the crisis situation, platform characteristics of media synchronicity and richness of expression affected the likelihood of rumor recipients believing the false rumor to be a true message. Second, rumors received from people with closer social ties were more likely to be believed as true. Third, rumor belief during the crisis was associated with greater intensity of informational and behavioral actions. Our findings provide governments with insights to mitigate the spread of hate rumor especially under community disaster situations. Implications for research and policy are discussed. This paper contributes to the IS literature on rumor theory and its implications by explaining how diverse communication technologies are used in a community crisis, thereby opening new avenue for future research to address the negative consequences of using communication media in the complex ICT mediated world. It shows how media characteristics along with social ties affect the "politics of plausibility".

1. Introduction

Recent events have repeatedly shown that the informational and behavioral responses of citizens to hate rumors have significant impacts on the population and hence on governments. For example, in Ferguson, Missouri, U.S., public prosecutor Robert McCulloch stated (Cushing, 2014):

"On August 9, Michael Brown was shot and killed by police officer Darren Wilson. Within minutes, various accounts of the incident began appearing on social media — accounts filled with speculation and little, if any, solid, accurate information … Following close behind were the nonstop rumors on social media. I recognize the lack of accurate detail surrounding the shooting frustrates the media and the general public and helps breed suspicion among those already stressed out by the system."

The negative effects of rumors as a form of false information are well documented in the literature of crisis communications (Burrell, 2013; Danzig, Thayer, & Galanter, 1958; Esposito & Rosnow, 1983; Scanlon, 1977). The capability of managing harmful rumors is imperative to mitigate unanticipated community problems (Rosnow, 1991; Rosnow and Fine, 1976), and the capability becomes increasingly important in today's hyper-connected information society. Recognizing the negative impact of false rumors on crisis management activities, the US Federal Emergency Management Agency (FEMA) has begun to operate rumor control systems to refute false rumors that spread rapidly especially under crisis situations.[1] However, the response of citizens to hate rumors is relatively unstudied in the research literature.

This paper examines the largely unexplored dark side of Information and Communications technology (ICT) in terms of its impacts on rumor belief and subsequent actions at the social level. We theoretically explicate the technological cues of communication media that can affect rumor belief and dissemination. Different from previous rumor research

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[1] http://www.fema.gov/disaster/4117/updates/oklahoma-tornado-rumor-control (Accessed on May 1, 2017).

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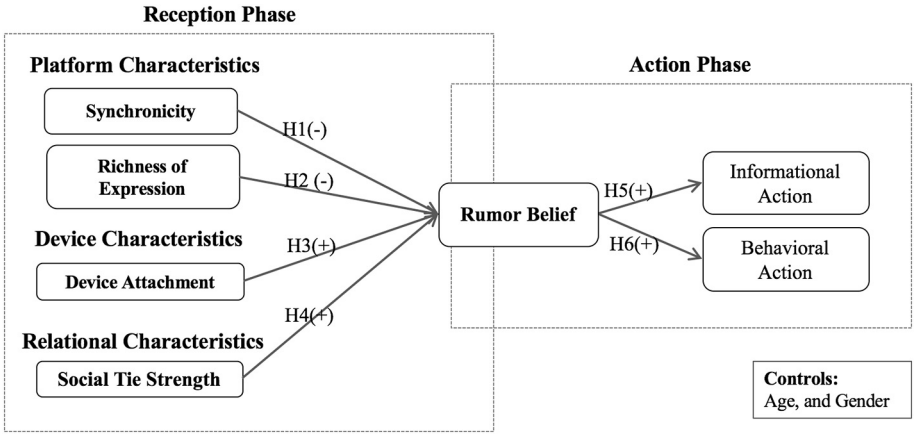

Fig. 1. Conceptual model of the reception and action phases.

that has focused on explaining rumor generation and diffusion mechanisms, we broaden the investigation by measuring the behavioral effects of rumor dissemination on a community targeted by a hate rumor. For this research, we analyzed a unique dataset collected from a real hate rumor spread incident, which engendered the mass exodus of over 15,000 people of a specific ethnic group from the relatively peaceful and highly connected technological city of Bangalore in India in 2012.[2]

This paper contributes to our pressing need to understand the complete life cycle of events (message reception, acceptance and action) in response to a concerted malicious effort to use social media for large-scale disruptions in the population. Unlike much prior research which largely uses perceptual data, in this paper we use data from an affected population, thereby examining actual behaviors, not just perceptions. The focus on the properties of the ICTs and communication channels, allows us to understand how the new communication technologies influence acceptance and response to large scale hate rumors.

In this paper we consider rumor impacts in two phases – a reception phase and a response (or action) phase. The reception phase examines the impacts of media characteristics on rumor belief and the response phase examines the impact of rumor belief on the informational and behavioral actions taken by the rumor recipients. In our two-phase model, the reception phase draws from the MAIN model (Sundar, 2008) and the response phase draws from the extended parallel processing model (EPPM) (Popova, 2012; Witte, 1994).

The MAIN model identifies four technological affordances with significant psychological effects on information acceptance – modality, agency, interactivity and navigability. Its key point is that each of these affordances can convey a variety of cues, which can lead to various cognitive heuristics influencing the credibility assessment of received information (Sundar, 2008). The MAIN model allows explication of the way online users interact with these affordances to drive information acceptance. Accordingly, we draw upon the MAIN model for the reception phase, to explicate the conditions under which online citizens accept false rumor messages as true in a crisis situation.

For the response phase, drawing upon the extended parallel processing model (EPPM), we examine how hate rumor belief generates informational and the behavioral consequences in the target community. EPPM is a well-studied theory to explain the conditions under which fear appeals succeed in generating behavioral responses (Popova, 2012; Witte, 1994). The EPPM treats the cognitive and emotional responses, activated by a fear appeal, as parallel processes, and presents determinants of the different reactions to a fear appeal. This is a useful foundation for our research, which examines the impact of rumor belief on responses. Together, the two phases provide a parsimonious foundation to examine the impacts of rumors disseminated by ICTs.

A significant contribution of this study lies in the measurement of the behavioral consequence of rumor belief under crisis situation. Whereas prior research has generally examined behavioral intentions as a result of information reception in hypothetical situations (Westerman, Spence, & Lachlan, 2009), our study examines behavioral actions taken in response to received rumors in a real community crisis situation. Extending previous rumor research, we demonstrate the relevance of rumor belief as a trigger of extreme collective informational (rumor spreading) and behavioral (safety-seeking) consequences. First, we confirm that people who believe hate rumors as true messages tend to more actively forward the received rumors to others. Second, we find that people who believe the hate rumors as true messages tend to take extreme actions (e.g., rush to leave their own community) rather than mild or moderate actions (e.g., check safety of their acquaintances or stay at home without going outside). Indeed, these findings help us explain why uncontrolled safety-seeking behaviors, prompted by belief in false rumors, led to the chaotic collective behavior of the 2012 mass-exodus in India.

2. Theoretical background and hypotheses

While the mechanisms of rumor generation and diffusion have been well studied, the role of ICTs in rumor transmission has only recently begun to gain attention (Oh, Agrawal, & Rao, 2010; Oh, Agrawal, & Rao, 2013; Oh, Eom, & Rao, 2015). Considering that communication media influence the way messages are packaged, we argue that, in addition to the message content itself, characteristics of message-carrying ICT media also influence the way people perceive the received rumor message. This argument is in line with the inquiry on the material condition of messages that "lead audiences to provisional acceptance of a preferred claim and the possibility of further transmission or action" (Fine, 2009, p186). Specifically, in the context of a community crisis, our inquiry is to understand how the cues expressed by ICT media affect the way online citizens perceive unverified information and how it can bring about various behavioral effects in physical space (Oh et al., 2015; Walther & Parks, 2002).

As depicted in Fig. 1 below, our theoretical model divides rumor response into two phases: reception phase and action/response phase. The reception phase explores the antecedents that drive rumor recipients to believe a false rumor as a trustful message. To explore the antecedents, we pay special attention to the characteristics of message-carrying media that might affect the rumor belief and also theorize the effects of social ties (Sundar, 2008). Hypotheses for the reception phase (i.e., H1, H2, H3, and H4) are built on the basis of rumor theory (Allport & Postman, 1947; Bordia & DiFonzo, 2004; Festinger, 1962; Shibutani,

[2] http://www.bbc.co.uk/news/world-asia-india-19292570 (Accessed May 1, 2017).

1966) and draw from the MAIN model that discusses credibility assessment of information received from online channels (Sundar, 2008). The MAIN model suggests that various cues expressed by digital technologies influence receivers' judgment of the credibility of received information (Sundar, 2008).

Hypotheses for the action/response phase are drawn primarily from the extended parallel process model (EPPM). In the action phase, we explore two action types that rumor recipients can take when they believe the received false rumor messages to be truthful: (1) informational actions (*H5*) whereby rumor recipients forward the received false rumors to others when they believe the received false rumors as true and (2) behavioral actions (*H6*) whereby rumor recipients take (a range of) behavioral actions (e.g., stay at home without going outside or leave their own community seeking safety) when they believe the received false messages as truthful messages.

2.1. Effects of media characteristics on rumor belief

We generalize prior studies (Garrett, 2011) by abstracting two distinct dimensions of the communication media: (1) communication platforms and (2) communication devices. *Communication platforms* refer to the software aspect of ICTs such as email, social network websites, short message services (SMS), multi-media message services (MMS), voice communication applications, and the open web that allow users to come together, create and share information (Gupta & Brooks, 2013). *Communication devices* refer to the hardware aspect of ICTs such as cell phones, smart phones, personal computers and tablets etc. We suggest (as discussed in subsequent subsections) that the media characteristics of both the platforms and the devices have an effect on rumor belief. Fig. 1 below depicts the conceptual research model.

2.2. Platform characteristics: effects of media synchronicity on rumor belief (*H1*)

As a kind of crisis communication, rumor is defined as an unverified message (information) with no credible sources attached (Allport & Postman, 1947; Bordia & DiFonzo, 2013; DiFonzo & Bordia, 2007b; DiFonzo & Bordia, 2013). During crisis situations, the *truth bias* phenomenon observed in human communications can lead to message acceptance by skipping the verification process, particularly, when information is received through non-synchronous channels (Burgoon, Blair, & Strom, 2008; Feeley & Young, 1998; Zuckerman, DePaulo, & Rosenthal, 1981). The truth bias indicates that, by default, people tend to accept an ambiguous message as a true message (instead of being skeptical about its veracity), and assume that it is not false. The truth bias arises from mental shortcuts that prime people's cognition to conform to prior experiences that communications have been and will be plausible most of time (O'Sullivan, 2003). Fine (2009) points out that "most audiences are predisposed to accept the claims of others unless there are compelling reasons to suggest caution." As a result, even for unverified messages, the "incoming message is initially tagged as truthful" (Burgoon et al., 2008).

It is in this context that the platform characteristic of media synchronicity becomes important. In the absence of synchronous feedback exchanges, the communicators' subsequent actions to verify the unsubstantiated rumor message are likely to be skipped and the rumor may be believed to be plausible (Sundar, 2008). It has been seen that a medium that supports synchronous communications triggers numerous heuristics such as choice (which implies greater accessibility of information) and responsiveness (which is pertinent to speed of response, etc.), which help in the credibility assessment of the received messages (Sundar, 2008). In crisis situations, the media characteristics of synchronous communications can be leveraged to improve the accuracy in assessment of a received false rumor message. Therefore, we submit the following hypothesis for time pressing crisis situations:

Hypothesis 1. (H1): *Media synchronicity has a negative relationship with rumor belief.*

2.3. Platform characteristics: effects of media's richness of expression on rumor belief (*H2*)

Daft, Lengel, and Trevino (1987) point out that communication media support different levels of richness of expression according to the degree that they can mimic face-to-face human communications (p. 35). In the hierarchy of media richness, communication media are categorized from highly rich (e.g., face-to- face communication) through medium rich (e.g., telephone) to lean (e.g., note, memo, letter, bulletin etc.) media. Cues for the richness of expression reflect the capability of communication media that can pad textual messages and activate the realism heuristic – that leads to people being more likely to trust audio-visual modality as opposed to textual modality because the content has a higher resemblance to the real world (Sundar, 2008). An increase in the ability of a medium to support the realism heuristic should lead to increased credibility evaluations and increased acceptance (rejection) of trustworthy (untrustworthy) evaluated messages.

The greater the availability of expressive cues, the more they can help in credibility evaluations and in identifying deception. Dziubinski's (2003) study empirically showed the importance of media's richness of expression in recognizing deceptive messages. It reported that the rate of deception detection is highest when a message is delivered through highly expressive media (e.g., video communication), lower when delivered through less expressive media (e.g., audio communication) and lowest when delivered through least expressive media (e.g., text-based online chat). The implications of the media's expressive cues are eloquently summarized as "[w]ith email we needn't worry about so much as a quiver in our voice or a tremor in our pinkie when telling a lie. Email is a first rate deception-enabler" (Hancock, 2007; Keyes, 2004). To this argument, Garrett's (2011) political rumor study adds another piece of empirical evidence that individuals are "uniquely biased toward believing rumors that arrive via email" (p. 260). It highlights that, compared to rich media, closed email communication media significantly lack the expressive cues that can be helpful in assessing and rectifying falsity in received messages. Therefore, we submit the following hypothesis on the role of media's richness of expression under time pressing crisis conditions:

Hypothesis 2. (H2): *Media's richness of expression has a negative relation with rumor belief.*

2.4. Device characteristics: effects of media device attachment on rumor belief (*H3*)

Media communication devices have many uses and gratifications attached to them (West & Turner, 2009). People personalize them and use them for sociability, entertainment, fashion as well as ease of access and psychological reassurance. Some devices are better for accessing certain types of platforms because they have varying levels of mobility, accessibility and ease of use, (Leung & Wei, 2000) thereby supporting the flow heuristic which relates to the level of immersion achieved by the user during the course of experiencing the interactive system (Sundar, 2008).

Bechwati and Xia (2003) point out that there are technological cues embodied within each category of communication device. Whether wittingly or not, the greater the presence of such cues, the more prolonged and pleasant will be the use of the device, resulting in the increased level of familiarity with the device. Vincent (2006) and Carter, Thatcher, Applefield, and J.M. (2011) argue that the continuous use of a mobile device intensifies a user's emotional attachment to the device itself. Obviously, this emotional attachment is attributable to the conscious or unconscious "sense that the device is an essential part of

everyday life with a value that goes beyond simple communication" (Kolsaker & Drakatos, 2009; p 267).

Studies show that, in comparison with other computing or communication devices, the mobile phone is a highly affective device. Drawing upon their empirical narrative study, Carter et al. (2011) find that the mobile phone acts as an emotional machine to keep continuous connection with family and friends as well as a personal organizer which is integral to managing everyday lives. This finding is similar to Lasen's (2004) assertion that the mobile phone is primarily an instance of "affective technologies" (p.1). Both studies imply that. as the emotional attachment to a device becomes strong, it inculcates a sense of "trust" in the technological system (belief that the system acts in the user's interests) that subsequently influences the acceptance of received information (Shih & Boortz, 2013).

Previous studies consider the emotional attachment uniquely bonded with the mobile capability of communication devices (Carter et al., 2011; Vincent, 2006). It is mainly because, distinct from other ICT devices (e.g., landline phone, desktop, laptop etc.), the mobile phone is primarily used among close acquaintances in social and business circles with an expectation they will function to their interests. We therefore argue that false rumor messages received through mobile phones are more likely to be considered plausible than messages received through non-mobile (e.g., landline phones and desktop computers) or less-mobile (e.g., tablets and laptop computers) ICT devices. Therefore, we submit the following hypothesis under time pressing crisis situations:

Hypothesis 3. (H3): *Device attachment has a positive relation with rumor belief.*

2.5. Effects of social tie strength on rumor belief (H4)

Beyond media characteristics (enunciated by the MAIN model), prior rumor theory suggests that social support is another critical component of rumor belief and transmission. For instance, without social support, rumors stop (Festinger, 1962), as they travel through paths paved through social ties. Rumor theories argue that, under crisis situations, people tend to turn to their close social networks such as "kin, friends, co-workers, and neighbors" to acquire situational information (Aguirre & Tierney, 2001, p4; Shibutani, 1966). Using information collected through unofficial social networks, people improvise, elaborate and fill the gaps of informational uncertainties (Aguirre & Tierney, 2001). Shibutani (1966) highlights the fact that rumors arise as a form of *improvised news* through communicational interactions with familiar people who experience common situations. Similarly, Festinger (1962) and Oh et al. (2013) emphasize that rumor transactions are reproduced and amplified through social support among like-minded groups of people.

Many rumor studies have shown that rumors travel faster through strong social ties (e.g., family members or neighbors) than through weaker ties (e.g., strangers) (Garrett, 2011; Lai & Wong, 2002). Interpersonal communication among trusted groups can be a very important source for information sharing during crises, especially among minorities (Spence, Lachlan, & Griffin, 2007). This is because strong social ties, which are built upon repeated social interactions, are highly correlated with mutual and affective trust, imposing social pressure to suspend doubts for the received ambiguous messages (Garrett, 2011; Shibutani, 1966). Similar findings have also been reported by Brown, Broderick, and Lee (2007) in the marketing domain, which shows that homophily has significant effects on the plausibility or recipient's believability of information, the formation of attitude, and positive interactions among people. Hence, we submit the following hypothesis under time pressing crisis situations:

Hypothesis 4. (H4): *Social tie strength has a positive relation with rumor belief.*

2.6. Effect of rumor belief on information action (H5)

Following the rumor reception phase (refer to Fig. 1), we proceed to the action phase. Rumor is a form of social exchange, and people would not knowingly transmit false information if they do not believe it as true (Esposito & Rosnow, 1983; Fine, 2007; Koenig, 1985; Oh, Agrawal, & Rao, 2011; Oh et al., 2013; Rosnow, 1991, 2001). In the rumor literature, this was captured by Chorus (1953), who emphasizes the role of an individual's "critical sense" (p.314) as a deterrent of rumor spread. Critical sense means a rumor recipient's "perspicacity" or "disposition to make decisions after reflection and consideration" (p. 314). It implies that a reduction in the rumor recipient's critical sense increases the probability of rumor transmission, while an increase in critical sense weakens it.[3]

The extended parallel processing model (EPPM) provides an insight to explain the practical importance of "critical sense" in processing threatening messages (Witte, 1994). Drawing upon fear-appeal theory, the EPPM explains that, if people perceive a threatening message as irrelevant or insignificant, they would not bother to process the message further (Witte & Allen, 2000). In contrast, if they perceive it as threatening as well as plausible, they would initiate danger control process in their cognition to prevent the potential threat from being realized in their community.

Such danger control processes involve actions of information sharing. The human drive to make sense of an uncertain crisis situation affects the way an individual exerts one's critical sense. It is particularly true when they believe a false rumor as a credible message to the extent that it can pose a significant threat in their community members. In this situation, they feel a need for circulation of the harmful message not only to dispel the uncertainties unfolding from the crisis situation but also to alert their community members to the potentially impending threat. This situational and psychological tension increases the recipients' disposition to share the received hate rumor message with their community members in an attempt at collective sense-making and threat-management (DiFonzo & Bordia, 2007a; Gelfert, 2013; Shibutani, 1966). We therefore hypothesize that:

Hypothesis 5. (H5): *People are more likely to transmit the received message to others (*i.e. *information action) if they believe the threatening rumor message as true rather than false.*

2.7. Effect of rumor belief on behavioral action (H6)

The EPPM suggests that, when the perceived threat from a believed hate rumor is high, individuals tend to adopt danger-control processes emerging from the instinctive drive for self-preservation. This instinct encourages message acceptance and behavioral actions to mitigate the danger posed by the imminent threat (Witte, 1994). We therefore expect that the belief in the plausibility of the threatening rumors results in greater self-preserving and safety-seeking behaviors. It may be noted that, while information danger control actions (H5) are likely to help others in their community, the behavioral danger control actions are intended for self-help. Therefore, under extreme crisis situations, if people believe the received hate rumor as a true message, they are likely to take safety seeking behaviors to avoid or adapt to the external situation. In the context of this study, the safety seeking behavioral actions range from mild actions (e.g., avoid being alone or not going outside) to extreme ones (e.g., leave their community in order to seek safety). To test the relation between rumor belief and behavioral action under time pressing crisis situations, we submit the following hypothesis:

[3] Chorus (1953) formulates the rumor spread mechanism as: $R \sim i \times a \times \frac{1}{c}$ where 'R' stands for rumor spread, 'i' for situational importance, 'a' for informational ambiguity, and 'c' for critical sense (p.314).

Hypothesis 6. (H6): *People are more likely to take safety-seeking behavioral actions to avoid a hostile situation if they believe the threatening rumor message as true rather than false.*

3. Research context: the 2012 Bangalore mass exodus

To empirically explore the research model depicted in Fig. 1, we sought to survey respondents who were directly affected by an event wherein a false hate rumor affected peoples' actions. In August 2012, tens of thousands of people from Assam and other northeastern Indian states suddenly fled India's largest technological capital, Bangalore, located in the southern part of India. This mass panic was caused by the spreading of false hate rumors on the last day of the holy month of Ramadan that violent attacks would be directed against people of Northeast Indian descent. The false hate rumor messages indicated that these planned violent attacks were in retaliation for riots that had broken out in the state of Assam a month earlier.[4] Well-crafted messages have exploited the observation that exemplar representations in media content can lead to inflated estimations about the communicated phenomena (Westerman et al., 2009). With the help of ICT networks, intense confusion and panic rapidly grew in the target communities, and the Indian government had to enforce a ban on mass-text messaging services for two weeks. However, by then it was too late, because over 15,000 people had already fled Bangalore in fear of personal safety, taking trains and buses to get to wherever they felt were safer locations. Examples of these rumors of "revenge attacks" widely spread via ICT include:

> "Plz [=Please] it's a request to everyone to call their relatives, son, and daughters FRM [=FROM] Bangalore to call them back as soon as possible. Last night 4 north east guys were killed by Muslims at Bangalore (2 manipuri, 2 nepali) and also the reports are after 20th i.e., Ramzan[5] after 2 pm they are going to attack every north eastern people. The main reason that started all this riot was the situation at Kokrajar of Assa … b aware of dis n [=be aware of this and] stay away from the danger do pass da msg 2[=do pass the message too][6]" (words in the square parentheses are added by the authors).

Adding to the rumor, some doctored videos and images were widely circulated as purported 'evidence' of Muslims being tortured by Northeastern ethnic Assamese. We now know that the doctored images can be easily found through Internet search and were taken originally while Buddhist monks were helping in humanitarian relief during the aftermath of an earthquake.[7]

This exodus was the result of concocted hate rumors that were perceived as credible and plausible. In India, the inhabitants of Northeastern areas are racially distinct from other communities, even within the racially diverse Indian society. These people migrated to urban centers in the Indian heartland for livelihood as well as to pursue their aspirations. They typically live in dense ethnic networks, and usually have little contact with the Indian mainstream population. Bangalore is a very popular place to work and believed to be less racist than other metros such as Delhi (McDuie-Ra, 2012). As a result, though Bangalore has a large migrant population of up to 340,000 from the Northeast, they have historically lived peacefully in these cities with no threats based on ethnicity (FirstPost, 2012). However, the fast and wide diffusion of the ICT-enabled false rumors was detrimental enough to drive wedges at the heart of the peaceful community, leading to the unusual 2012 mass exodus.

[4] http://world.time.com/2012/08/18/fearing-attacks-thousands-continue-to-flee-bangalore/ (Accessed on May 1, 2017).

[5] Ramzan (or Ramadan) is a fast practice of Islam that is held from sunrise to sunset during the ninth month of the Islamic calendar.

[6] http://rumoursandsocialmedia.wordpress.com/tag/rumor/ (Accessed on December 10, 2017).

[7] http://www.gettyimages.in/detail/news-photo/tibetan-monks-prepare-a-mass-cremation-for-the-victims-of-a-news-photo/98508832 (Accessed on December 10, 2017).

4. Research methodology

4.1. Data collection

Data collection during crises is challenging. Their unexpected and non-routine nature limits planning for data collection, leading to unfavorable conditions for researchers (Spence, Lachlan, & Rainear, 2016). In this research we performed a survey from December 2012 to March 2013 for this study. A critical part of the data collection effort was to identify the targeted respondents who received the rumors and could play the role of key informants to provide relevant information. Therefore, in combination with a snowballing technique, a "key informants" data collection method was used (Segars & Grover, 1998).

To ensure that the right people were chosen for the data collection, we took the help of facilitators including professors and Ph.D. research assistants of a college in Bangalore, India who personally knew the Northeastern people affected by the rumors. Church personnel, paying guest house landlords and the leaders of the Northeastern student associations were also requested for information about victims of the rumors. We also targeted restaurants where many of the Northeasterners worked as waiters and cooks. Three local research assistants were hired and trained based on their familiarity with Bangalore and access to the paying guest houses, churches, and colleges through their personal social networks.

The data was collected by either sending questionnaires to the affected people or through direct interviews with them by the research assistants. Out of 265 responses, 100 were collected by direct responses to an investigator while the remaining 165 responses were filled by respondents on printed copies of questionnaires or sent through emails. After removing missing or incomplete data, we secured 252 data sample for analysis. Demographic information about the respondents is shown in Table 1 below. We believe the survey is broadly representative of the Northeast population in Bangalore due to our outreach to diverse channels of personal and social networks mentioned above. As a result of these deliberate data-collection efforts, we believe that our dataset captures the politics of plausibility in terms of dynamics of rumor reception, transmission and its consequential actions during the hate rumor incident.

As the incident of the mass exodus might have involved psychological panic for the victims, we recognized that the survey respondents might show social desirability bias, overstating their good behavior and downsizing any undesirable behaviors (Nederhof, 1985). To control such biases, we employed three approaches in the survey design. First, we used the forced choice item method in which respondents were made to choose between items relevant to different topics, but possessing equal degree of social desirability (Humm & Wadsworth, 1935). The rationale was that, if items seemed equally desirable or undesirable to the respondents, their choice was not influenced by social desirability bias (Nederhof, 1985). Second, following Bradburn and Sudman's (1979) suggestions, we took special care to control memory fading effects. According to the psychology literature, while favorable incidents are clearly recalled, negative events unconsciously fade away (Walker & Skowronski, 2009). As we began the data collection 4 months after the incident occurred, we briefed and described retrospective statements about the incident at the beginning of the survey so that the respondents could recall the situations at that time. Third, we assured subjects that our survey was confidential, answering the survey was voluntary, and withdrawing from the survey was permitted at any time.

To construct our survey, we referred to Garrett's (2011) questionnaire that was used for his political rumor study.[8] The survey included the following key questions: (1) through whom did the

[8] We express our gratitude to Professor Garret who allowed us to modify and use his survey questionnaire for our research.

Table 1
Demographics of survey data (N = 252).

Category	Total respondents (%)
Gender	
Male	118 (46.83%)
Female	134 (53.17%)
Age	
15–23	182 (72.22%)
24 and above	70 (27.78%)
Occupation	
Student	179 (71.03%)
Working professional	49 (19.44%)
No response	24 (9.52%)
Housing	
Paying guest	128 (50.79%)
Hostel	37 (14.68%)
Rented house	72 (28.57%)
Own house	4 (1.59%)
No response	11 (4.37%)

respondents receive the unverified information regarding threats to Northeastern people, (2) through which communication devices and platforms did the respondents receive the unverified information, (3) whether they spread the unverified information, and (4) whether they acted on the received unverified information. In addition to these main questions, to obtain a better understanding of the situation, we asked open-ended questions regarding: (a) what kind of information was received, and (b) what behavioral actions were taken after receiving the information. We also added a question to let the respondents identify and describe the plausibility of the rumor message as false or true according to their belief at the time of the incident, and whether or not respondents trusted the received message.

In the initial pilot test with 10 subjects, we were informed that respondents were reluctant to answer questions specifically about the spread of rumors. This was because, at the time of the survey, they did not discern that the messages spread were false rumors. Rather, several of them believed that the rumor message was a true fact and they were in real danger. Hence, we changed the questions from asking about *the spread of rumor* to asking about *the spread of the threatening message*.

A critical feature of this data set is that, unlike the latent variables that have been used in much prior research on social media communications during emergencies based on Likert type scale items (Nguyen, Yoon, & Tsetsura, 2017), this data set captures actual usage, belief and behaviors of the members of the targeted community, through the employment of explicit variables. Further, unlike survey data that captures behavioral intentions in a hypothetical situation, our data allow us to relate information processing with subsequent behavioral actions in a real situation of community crisis.

4.2. Key measures

This section describes data coding procedure for the data collected. A summary of key variables is presented in Table 2.

The dependent variable, *Rumor Belief*, of the reception phase, was measured as a binary variable. If a survey respondent believed the threatening (rumor) message as a true message, then we coded it as '1,' otherwise as '0'. Independent variables (IV) with regard to media, i.e., the communication platforms and devices, were measured in terms of the actual use during the incident, as shown in Appendix A. The IV regarding social ties was measured by asking about the actual member of the close community who had been part of the hate rumor discussion at the time of the incident. Subsequently the variables were coded as follows.

Synchronicity variable was coded as an ordinal measure ranging from 1 to 6 to measure the effect of synchronous communication platforms, and their ability to support the choice and responsiveness heuristics (Sundar, 2008), on the probability of rumor belief (H1 in Fig. 1). We initially coded the data into three ordinal categories of high (numeric value 3), medium (numeric value 2) and low synchronous platform (numeric value 1). Voice communication platform was coded as highly synchronous, because it requires that both communicating partners be in sync to perform real time communications. Social media and SMS were characterized as more synchronous than email or online news due to two reasons. First, unlike email platform, the intelligent push-based data processing mechanism of social media platforms[9] requires no extra step of clicking to pull feedback, which affords rapid access to check updates or feedbacks. Second, compared to online news webpages, social media services are more likely to receive more relevant and frequent feedback from those people who know about the crisis situations.

From this initial coding, we calculated the combined values, representing the cases that the survey respondents received rumor message through more than one category of synchronous communication platforms. For example, if she or he received the rumor message through voice call (i.e., value 3 as high synchronicity) and Facebook (i.e., value 2 as medium-level synchronicity), then the combined value of 5 (i.e., 3 + 2) is assigned for the synchronicity variable. Therefore, the possible ordinal values for the synchronicity variable range from 1 to 6[10]:

- 1 if she or he received the rumor message only through a low synchronous platform,
- 2 if she or he received the rumor message only through a medium synchronous platform,
- 3 if she or he received the rumor message only through a highly synchronous platform,
- 4 if she or he received the rumor message through both high and low synchronous platform,
- 5 if she or he received the rumor message through both high and medium synchronous platform, and
- 6 if she or he received the rumor message through high, medium and low synchronous platform.[11]

The same coding logic was applied to other independent variables of *richness of expression, device attachment,* and *social tie strength*.

Richness of Expression variable was coded as an ordinal measure from 1 to 6. We followed the categorization of Daft et al. (1987) i.e., the "Hierarchy of Media Richness" that categorizes media richness according to its capabilities to mimic face-to-face human communication (p. 358) and activate the realism heuristic (Sundar, 2008). We first coded the variable in three ordinal categories of high (numeric value 3), medium (numeric value 2) and low expressive platform (numeric value 1). Subsequently, we calculated the combined values to consider the cases that survey respondents receive the rumor message through more

[9] For the push based data processing mechanism of Facebook that affords the close to real time commenting to a posted message, refer to https://www.facebook.com/notes/facebook-engineering/live-commenting-behind-the-scenes/496077348919/ (Accessed May 1, 2017).

[10] The summation of low (e.g., email with ordinal value of 1) and medium (e.g., Facebook with ordinal value of 2) synchronicity can produce 3 which is equivalent to high synchronicity (e.g., voice call). As it can override the unique effect of high synchronicity platforms, we built a different coding scheme to measure their effects on rumor belief. Details are reported as a robustness check in the penultimate section before "Conclusion and Discussions."

[11] Our coding scale that ranges from 1 to 6 is ordinal categorical. The ordinal coding scheme is different from a 6 point Likert scale which is "assumed" to be an equally spaced interval variable. Long and Freese, 2006 present their simulation results that the difference between ordinal categorical and continuous interval independent variables is negligible (p. 421). A similar view has been presented by Pasta (2009). In practice, the only difference is to make an assumption (similar to a typical Likert scale) that the ordinal categorical data are equally spaced. Following Pasta's (2009) advice, we repeated the regression model (1) on the next page by setting our independent variables as ordinal categorical and continuous interval variable. The results produce exactly the same result as reported in Table 4 for both regressions.

Table 2
Summary of key variables and data types (sample size = 252).

Phase	Variable name	Data type
Action/reception phase	Rumor belief (DV)	- Binary categorical
	- 1: believed the false rumor to be true	
	- 0: did not believe the false rumor	
	H1: synchronicity (IV)	- Ordinal categorical ranging from 1 to 6 (explained below)
	- High (i.e., Voice calls)	
	- Medium (i.e., Facebook, Twitter, SMS)	
	- Low (i.e., email & online news)	
	H2: richness of expression (IV)	- Ordinal categorical ranging from 1 to 6
	- High (i.e., face-to-face)	
	- Medium (i.e., voice calls)	
	- Low (i.e., email, SMS)	
	H3: device attachment (proxy - mobility) (IV)	- Ordinal categorical ranging from 1 to 6
	- High (i.e., cell phone, smart phone)	
	- Medium (i.e., laptop computer, tablet computer)	
	- Low (i.e., TV, landline phone, desktop computer)	
	H4: social tie strength (IV)	- Ordinal categorical ranging from 1 to 6
	- Strong (i.e., family members, relative)	
	- Medium (i.e., friend, colleague)	
	- Weak (i.e., stranger, anonymous)	
Action phase	Rumor belief (IV)	- Binary categorical
	Information action (DV_1)	- Binary categorical
	- 1: forwarded the received false message	
	- 0: did not forward the received false message	
	Behavioral action (DV_2)	- Ordinal categorical ranging from 0 to 5.
	- 0: no action taken	
	- 1: informed friends and check their safety	
	- 2: become more careful or avoid being alone	
	- 3: not going outside	
	- 4: tried to leave town, but failed	
	- 5: left the habitat for Northeast	
Others	Control variables	
	Age	- Interval
	Gender	- Binary
	- 0: female	
	- 1: male	

than one category of communication platforms having different levels of expressive capability. Therefore, like the *synchronicity* variable, the possible ordinal values for the *richness of expression* variable range from 1 to 6.

Device Attachment variable was also coded as an ordinal measure ranging 1 to 6. Coding decision was primarily driven by the level of mobility of devices that people can carry on their body and its attendant level of support for the flow heuristic and affective attachment to the devices (Carter et al., 2011; Lasen, 2004; Sundar, 2008). The variable was initially coded into three ordinal categories of high (numeric value 3), medium (numeric value 2) and low-level of device attachment (numeric value 1). Subsequently, the combined values were calculated to represent the case that a survey respondent receives the rumor message through more than one category of device. Therefore, the possible ordinal values for the *device attachment* variable range from 1 to 6.

Social Tie Strength variable, like other independent variables, was also coded as an ordinal measure ranging from 1 to 6. The coding criterion is a modified version of the interpersonal ties which Granovetter (2005) identified into three categories: strong, weak and absent tie. We first coded the variable into three ordinal categories of strong (numeric value 3), medium (numeric value 2) and low-level social tie strength (numeric value 1). Then, the combined values were calculated to consider the situation where a survey respondent receives the rumor message through more than one person who belongs to different category of social tie strength. Therefore, the possible ordinal values for the *social tie strength* variable range from 1 to 6.

Information Action variable, the first dependent variable in the Action phase, was coded as a binary categorical variable. The variable was coded as 0, if a survey respondent reported that she or he did not forward the received false rumor to their acquaintances. If she or he reported otherwise, it was coded as 1.

Behavioral Action variable, the second dependent variable in the Action phase, was coded as an ordinal categorical variable that ranged from 0 to 5, where 0 is used as a baseline (no) action of the multinomial logistic regression model (to be explained in the following section). According to the survey respondent's responses about their actions that they took in response to the rumor message (refer to the questionnaire item 5 in Appendix A), we categorized the severity of their actions as follows:

- 0: if they did not take any action
- 1: if they informed their friends and checked their safety
- 2: if they became more careful and avoided being alone
- 3: if they did not go outside the home or vicinity
- 4: if they tried to leave town, but failed
- 5: if they left their habitats for Northeast

Table 3
Descriptive statistics (N = 252).

Variable	Mean	Std. dev.	Min.	Max.
Gender			0	1
Age	22.31	2.923	17	35
Synchronicity	4.23	1.304	1	6
Expression	4.44	1.434	1	6
Device attachment	4.12	1.19	1	6
Kin ties	3.88	1.513	1	6

Descriptive statics for all independent and control variables is reported as Table 3.

4.3. Empirical models and analysis method

4.3.1. Reception phase

Our observations are at the level of each survey respondent. Given that the dependent variable (i.e., rumor belief) is dichotomous, the following binary logistic regression model is presented to test H1, H2, H3, and H4:

$$P\left[\frac{(Believe\ Rumor)}{1-(Believe\ Rumor)}\right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon \quad (1)$$

where x_1 = synchronicity, x_2 = richness of expression, x_3 = device attachment, and x_4 = social tie strength.

Binary logistic regression is appropriate with a binary dependent variable and with independent variables that are continuous or categorical (Field, 2005, p 218). It does not assume that independent variables are interval, normally distributed or linearly related with other variables (Tabachnick & Fidell, 1996). Further, the results of such a model yield outcomes that are easy to interpret as odds-ratios. The Spearman rank correlation test in Appendix B shows that all correlations are < 0.5, indicating that they are free from the concern of multicollinearity[12] (Kishore, Agrawal, & Rao, 2004-2005).

4.3.2. Action phase 1: effect of rumor belief on information action

The 'rumor belief' variable has been used as a dependent variable in the 'reception phase' so far. In the 'action phase,' the same variable is used as an independent variable to measure the probability that people might forward a received rumor message to others (i.e., 'informational action') when they believe it as a plausibly true message (i.e., 'rumor belief') (H5 in Fig. 1). For this measurement, both 'rumor belief' and 'informational action' variables are coded as binary. Therefore, we used the below binary logistic regression model to verify whether or not rumor believers are likely to forward the received rumor message to others.

$$P\left[\frac{(informational\ action)}{1-(informational\ action)}\right] = \beta_0 + \beta_1 x_1 + \varepsilon \quad (2)$$

where x_1 = *rumor belief*.

We found that there exists a high correlation between dependent and independent variable (i.e., −0.657 at $p < .01$), which is higher than the recommended correlation value of 0.5 to run binary logistic regression model (Kishore et al., 2004-2005). Therefore, in the next section, we interpret the correlation results in support of H5.

4.3.3. Action phase 2: effects of rumor belief on behavioral action

Lastly, to measure the effect of rumor belief on behavioral actions of target rumor recipients, we employed multinomial logistic regression. Behavioral actions taken by the target rumor recipients were coded as an ordinal categorical variable from 0 (i.e., mild action of "no action taken") to 5 (i.e., extreme action of "left the habitat for Northeast"). We employed the below multinomial logistic regression, which is appropriate for an ordinal categorical dependent variable with more than two levels of ordinal data (Tabachnick & Fidell, 1996).

$$P[y_i] = \beta_0 + \beta_1 x_1 \quad (3)$$

where x_1 = rumor belief. For this measurement, based on our survey data, we coded behavioral actions (y_i), which the targeted victims actually took, into ordinal categorical data ranging from mild action (coded as 0 i.e., "no action taken") to extreme action (coded as 5) as follows:

y_0 = no action taken,
y_1 = *informed friends or check their safety*,
y_2 = *became more careful or avoided being alone*,
y_3 = *not going outside*,
y_4 = *tried to leave town but failed*, and
y_5 = *left for Northeast*.

We recognize that a concern of endogeneity issue can arise due to the fact that the rumor belief variable, which was set as a dependent variable for the reception phase, is now used as an independent variable of the action phase. We believe, it is not a major concern for two reasons. First, as we used the multinomial logistic regression with ordinal categorical data, we do not need to run the Second Stage Least Squares (2SLS) analysis. While 2SLS (like OLS) assumes the normal distribution, to address the concern of correlation between the dependent variables' error terms and the independent variables, our multinomial regression with categorical dependent variable is free from the requirement of normal distribution. The second reason is that question #5 of our survey (in Appendix A) has been designed to directly measure the effect of rumor belief on the respondent's behavioral actions by asking "If you received the news or information on the threat, what action(s) did you take in response to the news or information on the threat? Please list relevant actions."

5. Estimation results and hypotheses testing

5.1. Reception phase estimation

As for the reception phase of our rumor model in Fig. 1, model 2 in Table 4 reports that, except for H3, all hypotheses (e.g., H1, H2, and H4) are supported. We ran the regression with two blocks. The first block regression (Model 1 in Table 4) presents the estimation of two control variables (i.e., age and gender). The second block regression (Model 2 in Table 4) reports the estimation for all independent variables in addition to the control variables. Both model 1 and model 2 show good model fits of Chi-Square values of $\chi^2(2) = 5.659$ ($p < .039$) and $\chi^2(6) = 58.16$ ($p < .00$)[13] respectively.

First, the negative sign of β (−0.519) suggests the significantly negative effect of platform synchronicity on the rumor belief at $p < .001$, indicating that, as the level of synchronicity increases, the odds of believing a received false rumor as a true message significantly

[12] Another way to check the presence of multicollinearity in a binary logistic regression model is to verify the Variance Inflations Factors (VIF) by running Ordinary Least Squares (OLS) regression for the same binary logistic regression model. Like OLS, if the VIF value turns out to be < 4, we can assure the absence of multicollinearity issue between independent variables (Field, 2005). We checked all VIF values were significantly < 4 (i.e., age = 1.026, gender = 0.03, synchronicity = 1.05, richness of expression = 1.1.05, mobile attachment = 1.057, and social tie strength = 1.099).

[13] The logistic regression results in Table 4 report two model fit indices: Model coefficients Chi-square value and Hosmer and Lemeshow Chi-square value. Logistic regression result produces model fit indices as Chi-Square values. The null hypothesis test for the former is that there is no difference between the model without independent variables and the model with independent variables. Therefore, this null hypothesis should be rejected (at $p < .05$) to show that the inclusion of independent variables into null model has significant effects on the dependent variable. In contrast, Hosmer and Lemeshow's Test assumes null hypothesis that the observed frequencies and expected frequencies are similar. Therefore, the null hypothesis should not be rejected (i.e., p-value should > .05) to show that there exists a good correspondence between observed and expected frequencies. In the body of this paper, for the convenience of reading flow, we describe only the Chi-Square model fit index (Field, 2005).

Table 4
Estimation result for rumor belief (N = 252).

	Model 1				Model 2				
	β (SE)	Exp(β)	95% C.I.		β (SE)	Exp(β)	95% C.I.		
			Low	Up			Low	Up	
Constant	1.889 (1.126)	6.613			6.044 (1.604)	421.401			
Gender	−0.146 (0.271)	0.864	0.508	1.468	0.135 (0.308)	1.145	0.625	2.095	
Age	**−0.113**** **(0.05)**	**0.893****	**0.809**	**0.985**	**−0.117**** **(0.057)**	**0.889****	**0.795**	**0.994**	
Synchronicity					**−0.519***** **(0.119)**	**0.595*****	**0.471**	**0.752**	**H1: supported**
Richness of expression					**−0.557***** **(0.117)**	**0.573*****	**0.456**	**0.72**	**H2: supported**
Device attachment					−0.193 (0.131)	0.825	0.638	1.066	H3: not supported
Social tie strength					**0.285**** **(0.114)**	**1.33****	**1.065**	**1.661**	**H4: supported**
Model fit	$\chi^2(2) = 5.659$ ($p < .039$) Hosmer & Lameshow = 9.793 ($p = .28$)				$\chi^2(6) = 58.16$ ($p < .00$) Hosmer & Lameshow = 10.391 ($p = .239$)				

Note: * indicates $p < .01$, ** $p < .05$, and *** $p < .10$.
Bold text indicates statistically significant results.

decrease (because Exp(β) = 0.595 is < 1). Therefore H1 is supported. Second, the negative sign of β (−0.557) indicates the significantly negative effect of the platform's richness of expression on rumor belief at $p < .001$, meaning that the higher the level of platform's richness of expression, the lower the odds of believing a received false rumor as a true message (because Exp(β) = 0.573 is < 1). Therefore, H2 is supported. Third, contrary to our hypothesis, the effect of device attachment on the rumor belief is not significant. Therefore, H3 is not supported. Lastly, the positive sign of β (0.258) signifies the significantly positive effect of social tie strength on the rumor belief at $p < .05$, implying that the stronger the level of social tie strength, the higher the odds of believing a false rumor as a true message (because Exp(β) = 1.33 is > 1).

A control variable, the negative sign of β (−0.113) of the age variable presents an unexpected finding on the negative effect of age on rumor belief at $p < .05$. It indicates that, compared to younger persons, older persons are less likely to believe a received false rumor message as a true message. Given that many survey respondents were young college students or the employees of local businesses with average age of 22.31 (refer to Table 3), we speculate that they could have been urgently and desperately contacted by their parents, resulting in belief regarding the plausibility of the false rumor messages as real messages of threat.

We could not find any interaction effects between synchronicity and richness of expression, between synchronicity and device attachment, and between richness of expression and device attachment.

5.1.1. Action/response phase estimation – informational action

In terms of the action phase of our rumor model in Fig. 1, the data analysis results show the support for H5 (i.e., informational action). We observed high negative Spearman correlation ($r = -0.675$ at $p < .01$) between rumor belief and informational action, and therefore we could not run the regression. The negative correlation implies that when people recognize a received unverified message as a false rumor message, they are less likely to forward the rumor message to others. Conversely, if they believe that a received unverified message is a true message, then they are likely to forward it to others. However, given that the high correlation does not necessarily indicate a causal relation, it should be understood as a temporal precedence of rumor belief over informational action (Seddon, 1997).

5.1.2. Action phase estimation – behavioral action

The relationship between rumor belief and behavioral actions taken is shown in Table 5 with a good model fit of $\chi^2(15) = 45.925$ ($p < .01$). To run the multinomial regression, we included the binary type of two control variables (i.e., student and gender[14]) in addition to the main variable of rumor belief. The regression result shows that control variables have no effects on the behavior actions that the survey respondents took. Instead, only the main variable (i.e., rumor belief) shows significant effects on their behavioral actions. Therefore, we explain the effects of rumor belief on the behavioral actions.

The reference category for the behavioral actions is “No Action” taken. Therefore, the different categories of actions in Table 5 should be interpreted as a relative probability of a specific action taken in comparison to the reference category of “No Action” taken (Tabachnick & Fidell, 1996). For example, the first category of behavioral actions taken in the second row (i.e., “Informed Friend OR Checked Their Safety”) is interpreted as follows: Compared to people who took “No Action”, if one believed a received false rumor message as a plausible (i.e., true) message, then she or he is 4.412 times (i.e., Exp(β) value) more likely to take the relatively minor behavioral actions of “Informed friend or checked their safety.”

In sum, Table 5 shows that, compared to non-rumor believers, rumor believers were 4.412 to 6.632 times more likely to take safety-seeking actions of “informed friend or checked their safety,” “become more careful or avoid being alone,” or “not going out”. Compared to those who took “No Action,” rumor believers were 14.967 to 17.143 times more likely to take the more extreme actions of “tried to leave town but failed” or “left town for North”. It is noteworthy to highlight the finding that rumor believers tend to take more extreme safety seeking behaviors (i.e., Exp(β) = 14.967 for “left town for North”) rather than milder behaviors (e.g., Exp(B) = 4.412 for “informed friend or checked their safety or Exp(B) = 6.632 for “not going out”). Also, many rumor believers “tried to leave town but failed” (Exp(B) = 17.143 for “tried to leave town”), for various reasons. The stronger relationship between rumor belief and extreme safety-seeking behaviors explain the sudden and chaotic mass-exodus phenomenon which was triggered by the hate rumor spread studied in this paper.

[14] The student variable was coded as 1, if the survey respondents were college students in the target area of rumor attacks. Otherwise, they were coded as 0. For the gender variable, female was coded as 0, and male as 1.

Table 5
Effects of rumor belief on behavioral actions taken (H6).

Behavioral action taken		β	S.E.	Sig.	Exp(β)	95% C.I. for Exp(β)	
						Lower	Upper
Informed friend OR Checked their safety	Student (=Yes)	−0.719	0.550	0.191	0.487	0.166	1.431
	Gender (=Male)	0.618	0.539	0.252	1.855	0.645	5.337
	Rumor (=Believed)	**1.484**	**0.551**	**0.007**	**4.412**	**1.497**	**13.004**
Become more careful OR avoid being alone	Student (=Yes)	−0.461	0.524	0.428	0.660	0.236	1.843
	Gender (=Male)	0.623	0.525	0.235	1.864	0.666	5.215
	Rumor believed	**1.825**	**0.546**	**0.001**	**6.204**	**2.128**	**18.091**
Not going out	Student (=Yes)	−0.340	0.456	0.457	0.712	0.291	1.742
	Gender (=Male)	−0.348	0.457	0.447	0.706	0.288	1.731
	Rumor believed	**1.892**	**0.473**	**0.000**	**6.632**	**2.627**	**16.744**
Tried to leave town but failed	Student (=Yes)	−0.737	0.629	0.241	0.478	0.139	1.641
	Gender (=Male)	0.705	0.626	0.260	2.025	0.594	6.905
	Rumor believed	**2.842**	**0.818**	**0.001**	**17.143**	**3.449**	**85.208**
Left town for North	Student (=Yes)	−0.893	0.587	0.128	0.409	0.130	1.293
	Gender (=Male)	0.656	0.574	0.253	1.928	0.626	5.932
	Rumor believed	**2.706**	**0.708**	**0.000**	**14.967**	**3.737**	**59.950**

1) The reference category for Action Taken is “No action was taken”.
2) “Rumor (=Believed)” variable means the probability of taking specific action based on the belief about the plausibility of the rumor, compared to the condition of not believing rumors to be true.
3) “Student (=Yes) variable means the probability of college student's taking specific action, in comparison to non-student.”
4) “Gender (=Male) variable means the probability of male's taking specific action in comparison to female.”
Model coefficients: $\chi^2 = 45.925$, $df = 15$ ($p < .01$).

5.2. Robustness checks

As detailed in Table 2, we coded high synchronicity as 3, medium synchronicity as 2, and low synchronicity as 1. According to this coding scheme, the summation of low synchronicity (having ordinal value of 1) and medium synchronicity (having ordinal value of 2) produces the ordinal value of 3 which is equivalent to high synchronicity. It raises a concern that the unique effect of high synchronicity platforms can be overridden by the summation value of 3. In fact, this concern applies to all other independent variables (i.e., Richness of Expression, Device Attachment, and Social Tie Strength) of the reception phase in Fig. 1.

To address this concern, we built a different coding scheme to test hypotheses with the regression model (1). We assigned three different ordinal values of (i) 4 for highly synchronous, (ii) 2.5 for medium synchronous, and (iii) 1 for low synchronous communication platforms. With this coding scheme, we could hypothesize that the summation value (i.e., 3.5) of medium (i.e., value 2.5) and low (i.e., value 1) synchronicity is still less than the high synchronicity (e.g., value 4). The same coding logic has been applied to all other independent variables (i.e., Richness of Expression, Device Attachment, and Social Tie Strength) of the reception phase in Fig. 1. The results table is reported in Appendix C. While slightly different from the estimations reported in Table 4, the regression results still shows consistent patterns, confirming the robustness of the estimations.

6. Conclusion and discussion

This paper examined the complete life cycle of a hate rumor disseminated over social media that caused large-scale disruptions in the population. Using data from an affected population, we examined actual behaviors, focusing on the properties of the ICTs and communication channels. This allowed us to understand how the increasingly widespread new communication technologies can influence acceptance and response to large scale hate rumors.

We examined the dark side of ICTs in rumor spread by studying an extreme ICT-mediated rumor incident – the hate rumors in August 2012 that targeted a specific ethnic community in the technological hub of Bangalore in India – leading to the mass exodus of over 15,000 members of the targeted group. We divided rumor impacts into the two phases of reception and action and drew upon the MAIN model to examine the reception phase and the EPPM model for the action phase. We augmented rumor theory by combining ICT characteristics with traditional rumor research, and tested how these characteristics influence rumor belief. In the context of community crisis, we found that certain media cues (e.g., synchronicity and richness of expression) affect people to better assess the veracity of rumor messages so that they are not deceived by them. This result provides empirical evidence for the affordance implications provided by different communication platforms.

Following rumor belief, in the action phase, the analysis results of H5 suggest that when people realized that the received rumor message was false, they were significantly less likely to forward the rumor to others. With regard to H5 and H6, we found that people who believed the received threatening rumors as true took both informational (i.e., rumor-spreading) and behavioral (i.e., safety-seeking) actions. Also, confirming the relevance of rumor belief as a trigger of extreme collective behaviors, people who believed the threatening rumors as true messages tended to take more extreme actions (e.g., rush to leave their own community) rather than mild or moderate actions (e.g., check safety of their acquaintances or stay at home without going outside) as opposed to no action.

We propose two possible reasons for this finding. First, in this paper, we have assumed a binary characterization of plausibility (i.e., true or false). However in an atmosphere of extreme uncertainly and ambiguity, a potential victim may not be able to characterize a rumor as true or false. Rumor recipients would not know until later, through discussion and receipt of more information perhaps from authorities and with secure standards of evidence, if the rumor was true or not. When rumor recipients need to consider the plausibility of a rumor in deciding on their behavioral action, especially in time pressing situations, plausibility would not be binary but fuzzier or more relative. Rather than be characterized in black or white terms, plausibility may perhaps be characterized as a continuum of strength or intensity (Bernardi & Ruston, 2013). We speculate that distinctions in plausibility (in terms of strength or intensity) of a rumor, among different audiences, could result in their more extreme safety seeking behaviors (Dalziel, 2013). For example, the mean age in our sample is 22.31 years (refer to Table 3). The relative inexperience of this population in dealing with rumors and misinformation campaigns could have increased the plausibility of the received information as well as the intensity of the

behavioral actions in response to the received rumors. This needs to be studied in future research.

Second, the type of message circulated in the rumor narrative would have an impact on the behavioral action. In the case of the Bangalore incident, the threat in the message was salient to mortality, i.e., to life and limb of a targeted community. Since the rumor narrative was not only embedded in the culture, history and the extant narratives of the Northeast community, but also cohered with the beliefs of the targeted community (Dentih, 2013), it became more credible and plausible. Further, with no dissenting voices (referred to as "defeater belief" by (Sunstein, 2014)) from outside the boundary, there was no opportunity for counter narratives to surface (Dentih, 2013). As we discussed in Hypothesis 6, the extreme threat in the rumor would in turn cause extreme social anxiety resulting in a danger-control response rather than a fear-control response, causing more safety seeking and self-preserving behavioral actions among the affected population. The lack of support for H3 on the impact of device mobility on rumor belief suggests that emotional attachment to devices did not constrain beliefs as hypothesized. It suggests that emotional attachment or trust in devices did not lead to rumor acceptance. While our study extends Garrett's (2011) study of political rumors, the implications for the discipline are important as discussed below.

6.1. Research implications

Focusing on the dark side of ICT, we examined the information acceptance as well as its informational and behavioral consequences at the social level. To our knowledge, this is the first study that augments rumor theory and information reception models with the ICT mediated perspective (see H1, H2, H3, and H4). We used the MAIN model and EPPM as the foundations for our research. Although Garrett (2011) empirically found that the email medium was vulnerable to rumor reception, his basic approach to communication technologies was human-centric. He assumed that email communications reflect "prior offline relations," and argued that the close offline social relations assumed in email communications posed an affective and "social pressure against fact-checking" on the received rumor message (p. 259). Extending this research, we suggest that examining communication technologies as sets of constraints and affordances for users in particular situations is equally important to "explain how and why the 'same' technology is used or has different outcomes in different contexts" (Majchrzak, Markus, & Wareham, 2016; p 272). Taking this perspective, our study found that, under time pressing crisis situation, certain technological characteristics (such as synchronicity and richness of expression) can function as cues to influence rumor recipients to believe an ambiguous rumor message as a plausible message.

Second, to our knowledge, our study is among the first that empirically measures the behavioral effects of a false rumor (i.e., H6) with real behavioral data collected from the victims of the hate rumor attack. While there have been qualitative case studies on the behavioral effects of a threatening flood rumor (Danzig et al., 1958) and impending earthquake rumor (Burrell, 2013) in a community, their findings mainly relied on anecdotal narrative analyses. Our study is unique in that we could access and collect the rare data from the real victims of the hate rumor, and report that, under time pressing crisis situations, rumor believers tend to take extreme behaviors, rather than mild ones, to cope with threatening situation.

This paper contributes to the IS literature on rumor theory and its implications by explaining how diverse communication technologies are used in a community crisis, thereby opening new avenue for future research to address the negative consequences of using communication media in the complex ICT mediated world. It shows how media characteristics along with social ties affect the "politics of plausibility" (Fine, 2009, p186).

6.2. Policy implications

Unexpected community crises increasingly involve rumor mongering at the collective level. Therefore, rumor control under crisis situations has been a critical issue for governments and emergency agencies to mitigate potential harms in the crisis stricken communities (Cushing, 2014; Esposito & Rosnow, 1983; Fine, 2007; Oh et al., 2013; Rosnow, 1991). As happened in the Ferguson, Missouri example, improper attention to these technology-mediated rumors in the early stages can lead to unnecessary escalation in force, further deteriorating the relationship between the government and the public. Governments therefore need to develop strategies that account for the potential adverse impacts of mobile communication technologies, especially during times of stress.

In that regard, our findings on information action (H5) gives a strong insight for practitioners. Tanaka, Sakamoto, and Matsuka's (2013) experimental study reports a finding that, when a rumor message is exposed to others' criticisms, the probability of forwarding the rumor to others significantly decreases. From this finding, as a means to curb the spread of harmful rumor, Tanaka et al. suggest to expose potentially harmful rumors to the public with "the corresponding criticism" made by other users (Tanaka et al., 2013; p 654). This implies that, government or community leaders need to recognize that "facts are an important antidote for poisonous rumors […] Get the facts promptly and circulate them as widely as possible" (Rosnow, 1991; p 494). Similarly, in the context of complex connected ICT environments, research suggests that crisis responders need to "refute the wrong (rumor) information and provide citizens with timely, localized and correct information through multiple channels such as website link, social network websites, RSS, email, text message, radio, TV or Retweets" (Oh et al., 2013; Sellnow, Littlefield, Vidoloff, & Webb, 2009; Veil, Sellnow, & Petrun, 2012). Disclosing correct information is considered an essential principle of crisis management (Cho & Hong, 2016). We concur with these suggestions that community leaders should be proactive in mitigating the potential damage that harmful rumors can introduce into a community, especially under community crisis situations such as ethnic conflicts, social uprisings, natural disasters, terrorist attacks etc.

6.3. Limitations and future directions

The study has several limitations. Since both the dependent and independent variables were gathered from the same survey, common methods bias is a potential concern (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). However, the fact that we asked about actual behavior in the survey mitigates some of the concerns. In addition, though we have taken steps to reduce social desirability bias and recall bias, the potential for these effects remains. Regarding the statistical approach, we performed multiple regression analyses to test the hypotheses. Multiple regressions tend to inflate the familywise errors in the statistical tests. However, this was necessary due to the correlations among the variables.

The research suggests some future directions to extend this research. Adopting EPPM to study actions taken in response to the received rumors, we have identified an opportunity to integrate the theories on fear appeals with the theories on rumor transmission. This paper suggests that the critical sense construct in rumor theories can be related to the message processing stage in EPPM. Future research can examine the nature of this relationship. At the same time, while this paper assumed a direct relation of critical sense with processing of fear message, future research can look at recursive impacts where danger control and fear control processes in turn influence the critical sense.

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Appendix A. Questionnaire for the 2012 hate rumor incident in Bangalore, India

Bangalore Assam and Northeast India research survey

This survey is part of an academic research project for the mass-exodus which was triggered by unsubstantiated and information on the threat targeting the Northeast origin people. The purpose of the survey is to gain insight into the mechanism of the (mis-)information spread through various means of communication (such as face-to-face, phone calls, SMSs, MMSs, mobile phones, social media websites etc.). While there is virtually no risk or direct benefit to you in participating, you will be assisting us in providing important information to build a framework to make cyber space more reliable and trustful. To get a total picture, we need the opinions of as many people as possible. The information you provide will be combined with responses from other participants of the survey and will remain strictly confidential. Participation is voluntary. You don't have to answer any question you don't want to, and you can end the survey at any time. The survey should take approximately 15 min to complete.

This survey is anonymous and will be kept confidential. The information that you provide will be used only for research to understand the rumor-spread phenomena of the 2012 mass exodus in the Southern metropolitan area of Bengaluru in India.

To recall the incident of the 2012 mass exodus, you can read the BBC news article - http://www.bbc.co.uk/news/world-asia-india-19292570.

1. Please tell us about you.

- Your age?
- Your gender?
- Where are you currently living? (dorm, rented house, or specify)
- Name of school/college you are currently attending?
- If you are a college student, which grade you are in?
- If you are not a college student, what is your current job?
- Do your family or relatives live in Northeast area of India?
- Your religion?

2. Did you ever receive news or information on the threat targeting the Northeast origin people in the month of June to August of 2012?

- Yes
- No

3. If you received the news or information on the threat targeting the Northeast origin people in the month of June to August, do you think that they are unsubstantiated rumors?

- Yes
- No

4. If you ever received the news or information on the threat, please describe the news or information on the threat you received, heard or read. Otherwise indicate.
5. If you received the news or information on the threat, what action(s) did you take in response to the news or information on the threat? Please list relevant actions. If you did not received the news or information on the threat, please indicate.
6. If you received the news or information on the threat, please tell us from whom did you RECEIVE the news or information on the threat (please choose all that applies).

- Direct family member
- Relative
- Friend
- Colleague
- Strangers
- Anonymous (others)

7. If you RECEIVED the news or information on the threat, please indicate through what communication channel did you RECEIVE the news or information on the threat (please choose all that applies).

- Phone call
- Word of Mouth
- Email
- Short Message Service
- Multimedia Message Service
- (Links to) Youtube
- (Links to) Facebook
- (Links to) Twitter
- (Links to) Portal Website (specify URL)

- Others (specify)

8. If you RECEIVED the news or information on the threat, please indicate through what communication media did you RECEIVE the news or information on the threat (please choose all that applies).

- Radio
- TV
- Newspaper or mainstream media website
- Landline phone
- Cell phone
- Smart phone
- Tablet PC
- Laptop
- Desktop
- Others (specify)

9. Did you ever FORWARD the (received or heard) news or information on the threat to other people?

- Yes
- No

10. If you forwarded the news or information on the threat, please describe the contents of the news or information on the threat that you FORWARDED?

11. Please tell us to whom did you FORWARD the news or information on the threat (please choose all that applies). If you did not forward the rumors, please indicate N/A.

- Direct family member
- Relative
- Friend
- Colleague
- Strangers
- Anonymous (others)

12. Please tell us through what communication channel did you FORWARD the news or information on the threat (please choose all that applies). If you did not forward the news or information on the threat, please indicate N/A.

- Phone call
- Word of Mouth
- Email
- Short Message Service
- Multimedia Message Service
- (Links to) Youtube
- (Links to) Facebook
- (Links to) Twitter
- (Links to) Portal Website (Specify URL)
- Others (specify)

13. Please tell us through what communication media did you FORWARD the news or information on the threat (please choose all that applies). If you did not forward the rumors, please indicate N/A.

- Landline phone
- Cell phone
- Smart phone
- Tablet PC
- Laptop
- Desktop
- Others (specify)

Thank you very much for your response.

Appendix B. Spearman correlations for the binary logistic regression

Correlation Matrix						
	Gender	Age	Synchronicity	Richness of Expression	Device Attachment	Social Tie Strength
Gender	1	0.021	-0.093	-0.123	0.02	0.141
Age	0.021	1	0.069	-0.053	0.171	-0.024
Synchronicity	-0.093	0.069	1	0.132	-0.123	-0.103
Expression	-0.123	-0.053	0.132	1	0.058	-0.389
Device Attachment	0.02	0.171	-0.123	0.058	1	-0.081
Social Tie Strength	0.141	-0.024	-0.103	-0.389	-0.081	1

Grey background indicates the matrix diagonal.

Appendix C. Robustness test

Estimation result for rumor belief (N = 252)

	Model 1				Model 2				
	β (SE)	Exp(β)	95% C.I.		β (SE)	Exp(β)	95% C.I.		
			Low	Up			Low	Up	
Constant	1.889 (1.126)	6.613			5.230 (1.718)	186.757			
Gender	−0.146 (0.271)	0.864	0.508	1.468	0.176 (0.326)	1.192	0.629	2.258	
Age	**−0.113**** **(0.05)**	**0.893****	**0.809**	**0.985**	**−0.131**** **(0.061)**	**0.877****	**0.778**	**0.988**	
Synchronicity					**−0.311***** **(0.079)**	**0.732*****	**0.627**	**0.856**	**H1: supported**
Richness of expression					**−0.452***** **(0.072)**	**0.636*****	**0.552**	**0.733**	**H2: supported**
Device attachment					0.021 (0.084)	1.021	0.866	1.205	H3: not supported
Social tie strength					**0.200***** **(0.070)**	**1.221*****	**1.065**	**1.400**	**H4: supported**
Model fit	$\chi^2(2) = 5.659$ ($p < .039$) Hosmer & Lameshow = 9.793 ($p = .28$)				$\chi^2(6) = 83.424$ ($p < .000$) Hosmer & Lameshow = 6.460 ($p = .596$)				

Note: * indicates $p < .01$, ** $p < .05$, and *** $p < .10$.
Bold text indicates significant results.

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