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Disaster communication ecology in multiethnic communities: Understanding disaster coping and community resilience from a communication resource approach

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ABSTRACT

The challenge for multiethnic communities to recover from disasters is well noted. Yet, research on which types of resources can help communities recuperate remains scarce. The current study explores how community-level communication resources—including interpersonal connections, local media storytelling, community-based organizations, and official emergency management communication—may function as a resource network for residents from diverse backgrounds to navigate the strenuous process of post-disaster recovery. Results based on a community survey confirm the positive link between disaster communication ecology and individuals' disaster-coping outcomes. Findings further identify ethnicity-based divergence where certain communication resources play a more important role than others.

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Natural disasters like hurricanes and earthquakes create an ambiguous situation for communities and their residents (Lowrey, 2004). With a heightened need for orientation and social and emotional support, individuals are motivated to seek a variety of resources to make sense of the environment, cope with the physical and psychological shock, and navigate the strenuous process of post-disaster recovery. While economic and other material resources are instrumental for disaster coping and recovery (e.g., Berke et al., 1993), communication processes in the form of interpersonal, mediated, and organizational communication have received growing attention (Eisenman et al., 2007; Houston et al., 2015; Spialek et al., 2016, 2019).

With growing empirical evidence documenting the positive link between communication and individuals' disaster coping experience (e.g., Coile, 1997; Kim & Kang, 2010; Spialek et al., 2016, 2019), however, the work conducted in the setting of multiethnic and minority communities is still scarce. Natural disasters are closely intertwined with issues like disparities and social vulnerability, where the negative impact of disasters often disproportionately falls on minority residents (Davidson et al., 2013; Walz, 2017). Socioeconomic divide, language and cultural barriers, and ineffective disaster communication are all compounding factors that make ethnic minorities more vulnerable to

disasters (Thomas et al., 2013). In light of such vulnerability, it is thus especially important to examine how communication resources can be leveraged to empower individuals and foster community resilience, which is defined as “a network of adaptive capacities that allows a community to recover after adverse events” (Houston et al., 2015, p. 271).

Taking a communication ecology approach (Ball-Rokeach et al., 2012; Broad et al., 2013), the current study bridges the gap mentioned above by examining how diverse residents are differently connected to communication resources and utilize them to cope with Hurricane Harvey, the costliest hurricane that struck the coastal area of Texas in August 2017 (Mooney, 2018). Communication ecology is a theoretical framework that views community members as embedded in a web of communication resources consisting of interpersonal talks, local media, and community-based organizations (Ball-Rokeach et al., 2012). By “community,” this theoretical tradition emphasizes not only the shared geographic location, but also the shared discourse about “who the community members are—their identities, desires, and shared lived experiences” (Kim & Ball-Rokeach, 2006, p. 413). When facing highly ambiguous situations like natural disasters, individuals are motivated to take advantage of communication resources from their community and rely on such networks to cope with disaster situations.

The current study first tests the empirical connections between disaster-related communication ecologies and individual, community-level outcomes. It then assesses the degree to which residents from diverse cultural backgrounds utilize such disaster communication ecologies. A cross-group comparison was conducted among White, Black, Hispanic, and Asian residents who were affected by Hurricane Harvey, using data collected from a community-wide online survey.

Literature review

Communication ecology as a resource network

Defined as “a network of communication resource relations constructed by individuals in pursuit of a goal and in context of their communication environment” (Ball-Rokeach et al., 2012, p. 4), communication ecology is a concept that evolves from the Media System Dependency Theory (MSD, Ball-Rokeach, 1985, 2008) and Communication Infrastructure Theory (CIT, Kim & Ball-Rokeach, 2006). The communication ecology concept shares the Media System Dependency Theory’s conception that individuals are active agents who construct their web of media systems. It is also an extension of the Communication Infrastructure Theory, which views individuals as part of a neighborhood storytelling network comprised of mediated, interpersonal, and organizational connections (Ball-Rokeach et al., 2001; Kim & Ball-Rokeach, 2006). From such a communication network, individuals can draw resources to engage in sensemaking processes, organize collective action, and ultimately achieve goals of various kinds.

Several assumptions undergird the concept of communication ecology. First, communication resources are distributed at multiple levels within the network (Broad et al., 2013). At the micro-level, interpersonal connections are the primary conduit through which residents gain communication resources as well as contribute to community-centered storytelling. Meanwhile, the resources can also be distributed from meso-level actors, including local media and community-based organizations. To capitalize on

such resources, individuals may seek information from media and connect with organizations through membership affiliations or event participation. Second, communication ecology is set in the “communication action context,” defined as the neighborhood environment where communication activities take place (Kim & Ball-Rokeach, 2006, p. 413). The strength of communication ecology can be enhanced or restricted by various characteristics of neighborhood context, such as the stability of a neighborhood, ethnic heterogeneity, or its economic status (Wilkin et al., 2010). Finally, communication ecology is dynamic and goal-oriented. Depending on the specific goal sought, individuals may rely on interpersonal, media, and organizational resources differently, which may result in varied configurations of the resource networks. During disasters, for example, past research has shown that individuals may connect to media and the internet at much higher levels than during regular times (e.g., Kim et al., 2004; Lowrey, 2004). It is therefore important to consider the nature of the goal when studying a specific communication ecology.

Thus far, the concept of communication ecology has been applied in contexts such as social movement organization (e.g., Broad, 2013), health information seeking (e.g., Gonzalez, 2013), and citizen disaster communication (e.g., Houston et al., 2015; Spialek et al., 2016). Broad (2013) studied the organizational communication ecology constructed by food justice organizations in South Los Angeles. He argued that organizations’ communication ecology enabled connections to be built with like-minded partners and enhanced an organization’s ability to influence the macro-level cultural values surrounding the food justice issue. Gonzalez (2013) applied the concept of communication ecology in the context of cervical cancer information seeking among Latinas. By mapping the web of communication resources that Latinas relied on for health information, the concept proves useful in improving the receptivity and effectiveness of health interventions. Finally, Spialek et al. (2016) examined residents’ communication ecologies after a tornado. Their survey study suggested that certain communication resources, such as interpersonal talk and tornado-related mental health talk, positively influenced individuals’ community resilience perception.

Given the goal-oriented nature of communication ecology, the next section details a specific communication ecology in the context of disaster coping and recovery.

Disaster communication ecology and disaster-coping outcomes

Spialek and Houston (2018) expand the idea of communication ecology and define disaster communication ecology as networks of “communication resources (e.g., organizations, media, and residents) that are utilized to cope with mental, behavioral, and physical health challenges occurring at different disaster phases” (p. 937). They further distinguish goals associated with disaster-coping as “problem-focused” versus “emotion-focused.” Across different phases of a disaster (e.g., pre-, during, and post-disaster), residents may prioritize these two goals differently, thereby constructing distinct communication ecologies and relying on the same communication resource to different degrees.

The instrumental role of disaster communication ecology in fostering community resilience is more formally articulated in a four-component model for disaster assessment and intervention (Houston et al., 2015). Drawing on the literature of

communication ecology, public relations, and strategic communication, Houston et al. (2015) lay out the following conditions conducive to disaster preparedness, coping, and recovery: first, the presence of robust communication systems in a community, which include media outlets, official sources of information, and other citizen communication infrastructure; second, the presence of strong community relationships that foster social capital, community engagement, and a sense of belonging; third, positive community attributes such as flexibility, creativity, diversity, and economic resources; finally, effective strategic communication processes geared towards community competence, community visioning, disaster and risk education, and economic development.

Building on disaster communication ecology and Houston et al.'s (2015) communicative approach to community resilience, the current paper focuses on disaster-coping outcomes at two levels: individual-level disaster-coping *self-efficacy* and *collective efficacy*, and the community-level disaster-coping outcome as indicated by *community resilience*. The dual-emphasis on the individual- and community-level outcomes is consistent with the “whole community” approach of disaster management (FEMA, 2011), which proposes that disasters are best managed when multiple agents of the community work together and take responsibility for their own resilience.

Specifically, disaster-coping self-efficacy is defined as “how well (individuals) motivate themselves and persevere in the face of difficulties; the quality of their emotional life and vulnerability to stress and depression; resiliency to adversity” (Benight & Bandura, 2004, p. 1131). Meanwhile, collective efficacy is the belief that a group, rather than individuals alone, can effectively solve problems and mobilize resources through concerted effort (Bandura, 1997; Li, 2018). As disaster response and recovery depend heavily on the trust of other community members and collective action (Benight, 2004), collective efficacy is an equally important component as individuals' self-efficacy. At the community-level, *community resilience* assesses a community's ability to adapt to an erupted environment and “bounce back” from a disaster or crisis (Houston et al., 2015; Manyena et al., 2011; Norris et al., 2008). To foster individual- and community-level resilience has been consistently made a priority for proactive and reactive disaster management (FEMA, 2011; Paton & Johnston, 2017)

To examine how different communication resources are related to the three forms of disaster-coping outcomes, the following proposes four forms of resources that are essential to residents' disaster coping efforts: (1) local media including both traditional and social media; (2) interpersonal connections; (3) community-based organizations; and (4) public and emergency management communication. These four components are discussed in greater detail below.

Local media

Individuals' reliance on news media for disaster information has long been noted in various streams of literature (e.g., Houston et al., 2012; Kodrich & Laituri, 2005; Miles & Morse, 2007). From a Media System Dependency perspective, for example, the greater use of news media during social disruption is naturally motivated by the need for information and sensemaking (Lowrey, 2004). Kim and Kang (2010) identified several functions of mass media ranging from educating the public about hazards, disseminating disaster-warning messages, to informing residents about disaster assistance procurement. They further found that the connection to local media was related to a

higher level of individuals' pre-hurricane preparedness. Li (2018) examined the relationship between media exposure, perceived efficacy, and protective behaviors during a public health emergency, finding that media coverage significantly predicted individuals' threat perception, whereas self-efficacy and collective efficacy both moderated the extent to which threat perception can translate into risk control behaviors.

Other than traditional news media, social media are rapidly becoming an alternative for individuals to acquire and disseminate disaster-related information. In fact, research has indicated that compared to traditional news media, social media can contribute to the building of community resilience to a greater degree (Spialek et al., 2016). First, social media enable real-time updates of a disaster, making residents not only the recipients but also providers of information (Sutton et al., 2008). Furthermore, social media are used as a platform to express emotions and exchange social support (An & Mendiola-Smith, 2020), which are viewed as "psychological first aid" to foster community resilience (Taylor et al., 2012, p. 20). For example, Silver and Matthews (2017) demonstrated that Facebook was a highly influential source of information and support platform for residents who were negatively impacted by a tornado.

To test the positive relationships between both types of media and individual, community-level outcomes of disaster recovery, the following hypotheses are proposed:

H1. Residents' connection to traditional local media is related to a higher level of disaster self-efficacy (H1a), collective efficacy (H1b), and community resilience perception (H1c).

H2. Residents' connection to social media is related to a higher level of disaster self-efficacy (H2a), collective efficacy (H2b), and community resilience perception (H2c).

Interpersonal talk

The second component of disaster communication ecology is interpersonal communication, and specifically, the talks that center around the disaster with one's family, friends, and neighbors. There are several functions of interpersonal talk at various stages of a disaster. First, interpersonal talk can become a trusted source of disaster-related information. Through neighborhood conversation, residents may tap into a more exclusive local information exchange network that is not accessible otherwise. Second, interpersonal talk is instrumental in organizing community-wide collective action. In the context of disaster coping and recovery, the act of "neighbors helping neighbors" is vital during disaster evacuation and relief delivery, and interpersonal talk is the lubricant that facilitates such peer-led relief (Moore et al., 2004). Last but not least, connecting with neighbors and other social connections during a disaster may foster a sense of togetherness, which may translate into greater involvement in post-disaster activities (Houston & Franken, 2015).

Kim and Kang (2010) argued that interpersonal disaster communication could reinforce the effect of news media, which worked in tandem with other communication processes and increased individuals' engagement in disaster preparedness activities both before and during a hurricane. Similarly, Spialek and Houston (2019) examined the relationships between a series of citizen disaster communication activities and the sense of neighborhood belonging and community resilience. The study identified the critical role of residents' interpersonal disaster communication in forming positive feelings about the community and enhancing community resilience.

Based on the theoretical mechanism and empirical evidence discussed above, the following hypotheses thus test the relationship between interpersonal talk and individual, collective-level disaster outcomes:

H3. Residents' interpersonal talk is related to a higher level of disaster self-efficacy (H3a), collective efficacy (H3b), and community resilience perception (H3c).

Community-based organizations

The role of community-based organizations in disaster relief has been extensively noted. The inter-organizational networks among nonprofits, especially those that are community-based, are an essential component of local disaster response systems (Doerfel et al., 2013 ; Kapucu et al., 2010). During disasters, community-based organizations can task with public service agencies to mobilize funds and volunteers necessary for efficient disaster relief.

The role of community-based organizations may be even greater at the post-disaster stage. As Storr and Haeffle-Balch (2012) argue, community-based organizations are uniquely equipped to access "local knowledge," the dispersed information and knowledge about a community (p. 306). Such ability gives community-based organizations an advantage after a major disaster. For example, Rivera and Nickels (2014) found that when government assistance after Hurricane Katrina became inadequate, local organizations such as faith-based groups stepped in and significantly supported post-disaster community development. Given the critical role played by community-based organizations, residents' connection to them may generate positive individual- and community-level outcomes:

H4. Residents' connection to community-based organizations is related to a higher level of disaster self-efficacy (H4a), collective efficacy (H4b), and community resilience perception (H4c).

Government and emergency management communication

Finally, disaster communication ecology is not complete without first responder organizations and their official communication. Research has found that the public still frequently refer to official sources in their online discussion of crises, highlighting the critical role of government and emergency management organizations as major information providers during disasters (Freberg et al., 2013).

Other than providing credible information, emergency management organizations like FEMA and local first responders are the primary actors that spearhead disaster relief efforts. Being able to connect to those institutions and access relevant resources is thus critical for residents to cope with and recover from a disaster.

H5. Residents' connection to government and emergency management communication is related to a higher level of disaster self-efficacy (H5a), collective efficacy (H5b), and community resilience perception (H5c).

The divergence of communication connections among multiethnic community

Empirical evidence identifies great divergence in terms of how well residents from diverse backgrounds cope with disaster and engage in post-disaster community building.

When a disaster strikes, it is consistently found that ethnic minorities fare worse than residents from majority group status (Bethel et al., 2013; Davidson et al., 2013; Norris & Alegria, 2008). A social vulnerability approach of disasters defines vulnerability as “the characteristics of a person or group and their situation that influences their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard” (Wisner et al., 2004, p. 11). Barriers that have been found to deter minority residents from accessing resources include language proficiency, socioeconomic status, chronic adversities, as well as cultural values such as fatalism (Norris & Alegria, 2008). At the community-level, diverse communities are also more disadvantaged compared to homogenous, tight-knit communities, because racial, ethnic, and socioeconomic divides all hinder the organization of collective action as well as community-wide resource flows (Storr & Haeffele-Balch, 2012).

Empirical work also documents the marked disparities in disaster preparedness and other coping outcomes across the ethnic lines. Burns (2014) compared the level of emergency preparedness efficacy between Caucasians and other ethnic groups, suggesting that the former group enjoyed a significantly higher level of efficacy, which helped alleviate mental anxiety associated with the disaster. In terms of psychological resilience, Perilla et al. (2002) identified ethnicity as a significant predictor, where Spanish-speaking Latinos suffered the highest level of post-traumatic stress disorder compared to other racial and ethnic groups.

The complexity brought by racial and ethnic diversity makes it worth considering if disaster-related communication resources may benefit diverse residents equally, given the majority of existing work has been conducted in demographically and culturally homogenous communities. Sporadic evidence suggests that diverse residents may have distinct preferences when it comes to disaster-related information. For example, Peguero (2006) found that Latino residents prefer turning to friends and family for disaster preparation information. Chen et al.’s (2013) study on a multiethnic community similarly found that Anglo, Hispanic, and Asian residents relied on interpersonal talk, local media, and community organizations to different degrees to obtain information about their community, suggesting the *ethnic boundedness* of communication ecologies. Various communication resources may be utilized differently by residents from diverse backgrounds, either due to cultural preferences or structural factors that limit their access to certain resource channels. To investigate how residents from different ethnic groups utilize disaster communication ecology, and how such ecologies are related to coping outcomes across major ethnic groups, the following two research questions are proposed:

RQ1: How were White, Black, Hispanic, and Asian residents connected to different components of disaster communication ecology during the disaster?

RQ2: Whether and how do the relationships between disaster communication ecology and disaster-coping outcomes (i.e., disaster self-efficacy, collective efficacy, and community resilience perception) differ across White, Black, Hispanic, and Asian residents?

Method

Sampling and data

A community survey was conducted in the greater Houston area with adult residents who experienced direct loss during Hurricane Harvey between October 28 and

December 28 2019, two years after the hurricane struck the coastal area of Texas in August 2017. The survey was conducted by Qualtrics, a professional survey service provider, by recruiting participants through its probability-based and opt-in web panels. Using quota sampling, Qualtrics invited eligible respondents from White, Hispanic, Black, and Asian backgrounds to complete the online survey, and the recruitment was actively made until reaching the quota of 200 respondents for each ethnic group. The survey took respondents on average 10–15 mins to complete, and a total of 1,063 attempts were made that led to a completion of 800 responses. Incomplete cases were removed.

Specifically, potential respondents were asked if they self-identified as belonging to one of the four racial and ethnic groups: (1) White, (2) African American, (3) Hispanic, and (4) Asian. Individuals who indicated belonging to one and only one group were further presented with another two screening questions about their disaster impact status.¹ First, respondents were asked if they lived in the greater Houston area between August and September 2017, when Hurricane Harvey hit the region. Second, whether the respondents or their household members experienced flooding, financial loss, or other types of loss due to the hurricane. Only those who answered “yes” to both questions were then directed to the webpage to review study consent and participate. Participants were provided with modest cash incentives (i.e., \$5 in e-reward currency) for completing the Qualtrics survey.

The final 800 participants consisted of 598 females (74.8%) and 199 males (24.9%). The average age of the participants was 36.3 ($SD = 13.09$), and they lived in the current neighborhood for an average 11.27 years ($SD = 10.09$). Almost half of the participants owned their current residence (47.5%, $n = 380$). The majority of the respondents had “some college education without degree” (25.9%, $n = 207$), followed by 22.6% with “high school graduate or GED” ($n = 181$), 21.5% with “bachelor’s degree” ($n = 172$), 13.9% with “associate degree” ($n = 111$), 9.5% with “graduate or professional degree” ($n = 76$), and 6.6% with “less than high school” ($n = 53$). In terms of household income, 9.8% made “less than \$10,000” a year ($n = 78$), 15.4% “between \$10,000 and \$24,999” ($n = 123$), 27.4% “between \$25,000 and \$49,999” ($n = 219$), 20.8% “between \$50,000 and \$74,999” ($n = 166$), 10.9% “between \$75,000 and \$99,999” ($n = 87$), 10.5% “between \$100,000 and \$149,999” ($n = 84$), and 5.4% made more than \$150,000 a year ($n = 43$). Finally, in terms of immigration status,² 14.9% ($n = 119$) were first-generation immigrants, 24.3% were second-generation immigrants ($n = 194$), and 54.6% were native born citizens ($n = 437$).

Measures

Disaster-related local media use

Local media use was measured in two steps. First, respondents were asked about their frequency of using TV, radio, and newspapers to learn about hurricane-related updates on a five-point scale ranging from “Never” to “Always.” Second, they were asked to indicate if the media sources were (1) mainstream English language media or (2) media channels that target their residential area or produced for their ethnic group. Only the indication of the second category was coded as 1, and the summation of all three responses formed the local media use scale ($M = 2.31$, $SD = .95$, Cronbach’s alpha = .69).

Disaster-related social media use

To measure the level of social media use for disaster, respondents were asked about how frequently they used social media like Facebook and Twitter to (1) learn about hurricane-related updates, (2) access disaster recovery information, and (3) seek for social support and vent emotions on a five-point scale (1 = Never, 5 = Always). The responses were then averaged to create a five-point composite ($M = 3.25$, $SD = 1.22$, Cronbach's alpha = .83).

Disaster-related interpersonal communication

Respondents were asked about how frequently they talked with neighbors to (1) learn about hurricane-related updates, (2) access disaster recovery information, and (3) seek for social support and vent emotion using a similar five-point scale. The measure was created by averaging responses to the three questions ($M = 3.03$, $SD = 1.17$, Cronbach's alpha = .85).

Disaster-related organizational connection

Respondents were asked about the frequency at which they reached out to local community organizations, such as churches, homeowner associations, or other groups, to (1) learn about hurricane-related updates, (2) access disaster recovery information, and (3) seek for social support or vent emotions. The composite was created by averaging the responses to the three questions ($M = 2.67$, $SD = 1.28$, Cronbach's alpha = .91).

Connection to government and emergency management communication

To assess the degree to which residents were connected to government communication about the disaster, the following four statements were presented for respondents to provide their levels of agreement on a five-point scale (1 = Strongly disagree, 5 = Strongly agree): (1) I closely follow hurricane-related information from government websites; (2) I closely follow hurricane-related information from government social media accounts; (3) I closely follow hurricane-related information from other offline sources like official brochures or pamphlets, and (4) I closely follow hurricane-related information by talking to government officials or visiting their offices. A composite was created by averaging responses to the four items ($M = 3.18$, $SD = .95$, Cronbach's alpha = .70).

Disaster-coping self-efficacy

Following Benight et al. (1999), hurricane-coping self-efficacy was measured by asking respondents how capable they thought they were in handling the following activities on a seven-point scale: (1) dealing with demands of clearing debris caused by the hurricane; (2) maintaining a sense of normality in daily routines; and (3) dealing with the disruption caused by the hurricane. The final scale is created by averaging scores of the three items ($M = 4.68$, $SD = 1.51$, Cronbach's alpha = .83).

Disaster-coping collective efficacy

Adapting the scale developed in Benight (2004), collective efficacy was measured by 12 items that asked respondents to rate how well *their community as a whole* handled Hurricane Harvey on a seven-point scale. The composite was created by averaging responses to the 12 items ($M = 4.96$, $SD = 1.35$, Cronbach's alpha = .96).

Community resilience

The current paper adopted the five-factor measure of community resilience developed by Pfefferbaum et al. (2013) as part of the Communities Advancing Resilience Toolkit (CART). Different versions of this measurement have been applied in studies such as Spialek et al. (2016) and Binder et al. (2015). The most up-to-date measurement includes the following five domains covering a total of 24 items: (1) connection and care, consisting of five questions such as “people in my community feel like they belong” ($M = 3.89$, $SD = .86$, Cronbach’s alpha = .88); (2) resources, consisting of four questions such as “people in my community was able to get the services they need” ($M = 3.50$, $SD = .95$, Cronbach’s alpha = .87); (3) transformative potential, consisting of six questions such as “my community has effective leaders” ($M = 3.66$, $SD = .88$, Cronbach’s alpha = .92); (4) disaster management, consisting of four items such as “community prepares for future disasters” ($M = 3.63$, $SD = .95$, Cronbach’s alpha = .86); and finally (5) information and communication, including four questions such as “my community keeps people informed” ($M = 3.65$, $SD = .91$, Cronbach’s alpha = .81).

Control variables

Standard socio-demographic variables like age, gender, educational level, and income were included as control variables in the regression models. In addition, as vulnerable populations, such as racial minorities and immigrants (Davidson et al., 2013), are disproportionately impacted by disasters, we further included ethnicity and immigrant status as control. Finally, studies suggested that place attachment was associated with community resilience perceptions (e.g., Zwiers et al., 2018). To control for such effects, we also included two place attachment variables, homeownership and residential tenure.

Analysis strategy

A series of hierarchical linear regressions were performed on the entire sample to test H1 through H5 using SPSS 26, where the dependent variables were disaster-coping self-efficacy, collective efficacy, and community resilience. In these models, the first block contained variables including socio-demographics, residential tenure, homeownership, and immigrant status. The second block consisted of five communication ecology variables. To ensure that the data met the assumptions for linear regression, all predictors were assessed to see if they were independent of each other. An examination of the bivariate correlation matrix (Table 1) revealed no substantial correlations among the predictors, and the variance inflation factor scores (VIF) for all the variables were within the range of 1.04–3.53, which were far below the rule of thumb of 10 (Hair et al., 2006), indicating no multicollinearity issue. In addition, the distribution of the three dependent variables—individuals’ disaster-coping self-efficacy, collective efficacy, and community resilience—were inspected for the level of skewness and kurtosis, all of which fell within the acceptable range.

To compare the level of connection to various communication resources across multiple ethnic groups (RQ1), a series of analyses of covariance (ANCOVA) tests were conducted while controlling for socio-demographic, immigrant status, and place attachment variables. To answer RQ2, the same hierarchical models were run in the four sub-samples

Table 1. Descriptive statistics and bivariate correlations among key variables (N = 800)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Gender																
2. Age	-.03															
3. Ethnicity	-.05	-.34**														
4. Education	-.09**	.09**	.16**													
5. Income	-.07*	.05	.10**	.45**												
6. Residential tenure	.03	.28**	-.10**	-.06	-.06											
7. Homeownership	-.11**	.15**	.06	.32**	.35**	.17*										
8. Immigrant status	.07	.14**	-.45**	-.18**	-.07*	.09**	-.06									
9. Local media connection	-.08*	.03	-.03	.06	.12**	.02	.07*	-.06								
10. Social media connection	.07*	-.22**	.10**	-.03	-.02	.02	-.12**	-.05	-.06	.29**						
11. Interpersonal connection	-.06	-.05	.01	.07*	.02	.12**	-.02	.04	-.06	.41**	.47**					
12. Organizational connection	-.01	-.06	.02	-.02	-.02	.00	.02	-.13**	-.06	.38**	.47**	.67**				
13. Gov and EM connections	-.04	-.05	.01	.01	.01	-.07	-.05	.01	-.04	.34**	.36**	.43**	.52**			
14. Disaster self-efficacy	-.05	-.04	.01	-.03	.00	.00	-.08*	.05	-.06	.14**	.02	.06	.07	.26**		
15. Disaster collective efficacy	-.00	-.03	.00	.02	.02	.07*	-.08*	-.00	-.04	.15**	.17**	.27**	.20**	.26**	.57**	
16. Community resilience	-.04	-.03	.01	.05	.08*	.08*	-.10**	-.00	-.03	.21**	.18**	.30**	.21**	.34**	.35**	.64**
Mean	-	36.3	-	3.73	4.49	11.27	-	-	2.31	3.25	3.03	2.67	3.18	4.68	4.96	3.67
SD	-	13.09	-	1.89	1.47	10.09	-	-	.95	1.22	1.17	1.28	.95	1.51	1.35	.80
Cronbach's alpha	-	-	-	-	-	-	-	-	.69	.83	.85	.91	.70	.83	.96	.97

Notes: Table values are zero-order correlations. * $p < .05$, ** $p < .01$.

of White, Black, Hispanic, and Asian residents, and the coefficients were then compared across groups.

Results

The relationship between communication ecology and disaster coping

H1 through H5 tested the role of communication ecology in predicting residents' disaster-coping self-efficacy, collective efficacy, and community resilience. Hierarchical linear regression results are presented in Table 1. All models were significant, and the addition of communication ecology variables accounted for an additional 9% to 20% explained variance across all models.

The first set of hypotheses tested the relationship between local media connection and three disaster-coping outcomes. Results suggested that local media connection was not significantly related to any disaster-coping outcome, so H1 was not supported. Social media connection, meanwhile, significantly predicted community resilience ($\beta = .128$, $p < .05$). But it was not significantly related to self-efficacy (H2a) or collective efficacy (H2b). The findings did not lend support to H2a or H2b but partially supported H2c. Regarding the role of interpersonal communication (H3), it was significantly related to all three disaster outcome variables, thus fully supporting H3a through H3c. Organizational connection (H4) was significantly related to coping self-efficacy ($\beta = .151$, $p < .05$) and community resilience ($\beta = .198$, $p < .01$), supporting H4a, H4c, but not H4b. Finally, connection to government and emergency management communication was a consistent predictor of both self-efficacy and collective efficacy, as well as community resilience, thus fully supporting H5a, H5b, and H5c (see Table 2 for specific coefficients).

The connection to communication resources across ethnic groups

To compare the average level of connection to the five types of communication resources constituting disaster communication ecology (RQ1) while controlling for socio-demographics, immigrant status, and place-based attachment variables, ANCOVA tests were conducted in the White, Black, Hispanic, and Asian sub-samples. Levene's test and normality checks suggested that all the assumptions were met. Table 3 presents the descriptive and adjusted means of local media connection, social media connection, interpersonal connection, local organizational connection, and government and EM connection for the four ethnic groups.

One-way ANCOVA analyses suggested that there was indeed ethnicity-based difference in the level of local media connection ($F(3,796) = 3.23$, $p = .02$), local organizational connection ($F(3,796) = 5.21$, $p = .001$), and government and emergency communication ($F(3,796) = 3.23$, $p = .03$). Further post-hoc analyses with LSD procedure indicated that Hispanic residents ($M_{adjusted} = 2.45$, $SD = .10$) had a significantly higher level of connection to local media than Asian residents ($M_{adjusted} = 2.08$, $SD = .90$). The difference in organizational connection was also significant between African Americans and the other three ethnic groups. Compared to all other ethnic groups, African American residents were most connected to local organizations for disaster information and social and emotional support ($M_{adjusted} = 3.00$, $SD = .10$). Finally, a significant difference was

Table 2. Hierarchical linear regression predicting self-efficacy, collective efficacy, and community resilience

	Disaster coping self-efficacy	Disaster coping collective efficacy	Community resilience
	β	β	β
Constant	-	-	-
Block I			
Gender	-.048	-.073	-.072
Age	.011	.037	.045
Ethnicity			
Black	.036	.019	-.084
Hispanic	.094	-.066	-.166*
Asian	-.035	-.120	-.124
White (reference)	-	-	-
Education	-.046	-.016	-.052
Income	.015	.012	.034
Residential tenure	-.089	.015	-.011
Homeownership	.062	-.061	-.096
Immigrant status	-.173**	-.097	-.079
R²	.063	.030	.039
F	2.481**	1.155	1.484
Block II			
Local media connection	-.005	-.042	-.044
Social media connection	-.013	.073	.128*
Interpersonal connection	.152*	.272***	.249***
Org connection	.151*	.097	.198**
Gov and EM connection	.284***	.168**	.351***
R²	.148	.150	.249
F	4.194***	4.284***	3.699***

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$.

observed between White ($M_{adjusted} = 3.10, SD = .08$) and African American ($M_{adjusted} = 3.40, SD = .08$) residents in their connection to government and emergency communication, but not for Asian or Hispanic groups (Figure 1).

RQ2 compared the relationship between communication ecology and disaster-coping outcomes across the four ethnic groups. Tables 4–6 present the hierarchical linear model results across the four groups when predicting self-efficacy, collective efficacy, and community resilience perception.

Significant divergence emerged with regard to which type of communication resources best predicted each disaster-coping outcome across ethnic groups. While the role of local media was still minimal, local media connection was positively correlated to Asian residents’ disaster-coping self-efficacy ($\beta_{self-efficacy} = .233, p < .05$). Meanwhile, there was a significant negative association between media connection and Black residents’ collective efficacy ($\beta_{collective-efficacy} = -.268, p < .05$).

Social media connection was positively correlated to Hispanic residents’ collective efficacy ($\beta_{collective-efficacy} = .290, p < .05$) and community resilience perception ($\beta_{community-resilience} = .340, p < .05$). It also significantly contributed to Asian residents’ community resilience ($\beta_{community-resilience} = .210, p < .05$). However, it was negatively associated with Black residents’ collective efficacy ($\beta_{collective efficacy} = -.290, p < .05$) and did not predict any disaster-coping outcome among White residents.

Interpersonal connection was significantly related to White residents’ collective efficacy ($\beta_{collective efficacy} = .338, p < .05$) and community resilience perception ($\beta_{community-resilience} = .389, p < .01$). It significantly predicted Hispanic residents’ self-efficacy (β_{self-

Table 3. ANCOVA test comparing the level of connection to disaster communication ecology across the four ethnic groups

	White (N = 200)						Black (N=200)						Hispanic (N=200)						Asian (N=200)							
	Descriptive		Adjusted		Descriptive		Adjusted		Descriptive		Adjusted		Descriptive		Adjusted		Descriptive		Adjusted		Descriptive		Adjusted			
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	ANCOVA F	p
Connection to Local Media	2.38	.92	2.28	.10	2.41	.99	2.44	.10	2.37	.97	2.45	.10	2.08	.91	2.08	.09	2.08	.09	2.08	.09	2.08	.91	2.08	.09	3.23	.02
Connection to Social Media	2.97	1.22	3.08	.09	3.37	1.26	3.36	.10	3.33	1.14	3.28	.09	3.33	1.14	3.25	.10	3.33	1.14	3.25	.10	3.33	1.14	3.25	.10	1.59	.19
Interpersonal Communication	3.00	1.16	3.03	.09	3.07	1.24	3.12	.09	2.97	1.21	3.00	.09	3.07	1.06	2.93	.09	3.07	1.06	2.93	.09	3.07	1.06	2.93	.09	.67	.57
Connection to Organizations	2.64	1.20	2.56	.10	2.65	1.26	3.00	.10	2.92	1.32	2.61	.10	2.46	1.28	2.50	.10	2.46	1.28	2.50	.10	2.46	1.28	2.50	.10	5.21	.00
Gov & EM Comm	3.08	.92	3.40	.80	3.33	1.05	3.40	.08	3.14	.06	3.10	.08	3.16	.83	3.09	.08	3.16	.83	3.09	.08	3.16	.83	3.09	.08	3.23	.03

Notes: Covariates in the ANCOVA analysis included gender, age, education, income, residential tenure, homeownership, and immigrant status.

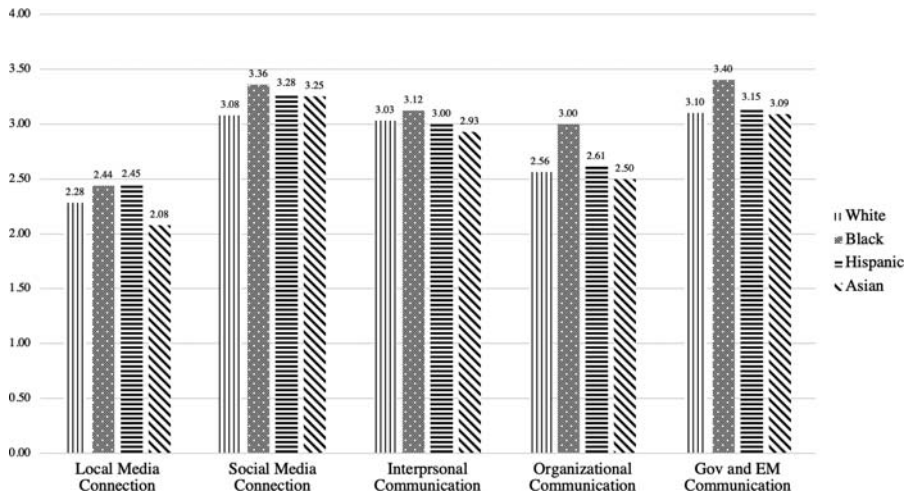


Figure 1. The adjusted mean plot of individuals' connection to different communication resources across the four ethnic groups.

Table 4. Hierarchical linear regression predicting self-efficacy across the four ethnic groups

	White β	Black β	Hispanic β	Asian β
Constant	-	-	-	-
Block I				
Gender	-.153	-.140	.197	-.026
Age	.056	.086	.042	-.093
Education	.024	-.147	-.004	-.064
Income	-.013	.039	.045	-.012
Residential tenure	-.129	-.170	.018	-.111
Homeownership	.090	.193	.086	-.162
Immigrant status	-.114	-.098	-.273*	-.127
R²	.064	.144	.091	.098
Block II				
Local media connection	.033	-.055	-.208	.233*
Social media connection	.076	-.106	-.072	-.028
Interpersonal connection	.054	.182	.441*	.060
Org connection	.037	-.084	.332*	-.199
Gov and EM connection	.257*	.279*	.223	.316**
R²	.156	.233	.230	.226

Notes: The dependent variable for all four models is the level of disaster-coping self-efficacy. * $p < .05$, ** $p < .01$, *** $p < .001$.

efficacy = .441, $p < .05$) and Black residents' collective-efficacy ($\beta_{collective-efficacy} = .508$, $p < .01$). On the other hand, this variable was not significantly related to any disaster-coping outcome among Asian residents.

Across all four ethnic groups, the organizational connection was only significantly related to Hispanic residents' disaster-coping self-efficacy ($\beta_{self-efficacy} = .332$, $p < .05$).

Finally, government and EM communication turned out as a consistent predictor of all three disaster-coping outcomes among Asian residents ($\beta_{self-efficacy} = .316$, $p < .01$; $\beta_{collective-efficacy} = .323$, $p < .01$; $\beta_{community resilience} = .420$, $p < .01$). It was also significantly related to White and Black residents' self-efficacy ($\beta_{White} = .257$, $p < .05$; $\beta_{Black} = .279$, $p < .05$) and community resilience perception ($\beta_{White} = .244$, $p < .05$; $\beta_{Black} = .568$, $p < .001$). For

Table 5. Hierarchical linear regression predicting collective efficacy across the four ethnic groups

	White β	Black β	Hispanic β	Asian β
Constant	-	-	-	-
Block I				
Gender	-.118	-.074	.106	-.136
Age	.134	-.001	-.004	.054
Education	.038	-.119	.022	-.036
Income	-.013	-.023	.259*	-.057
Residential tenure	.011	.126	-.110	-.123
Homeownership	-.161	-.024	-.034	-.062
Immigrant status	.010	.000	-.221*	-.079
R^2	.043	.049	.137	.122
Block II				
Local media connection	.075	-.268*	-.219	.114
Social media connection	.153	-.290*	.290*	.173
Interpersonal connection	.338*	.508**	.126	.085
Org connection	-.076	.043	.044	.168
Gov and EM connection	.119	.133	-.007	.323**
R^2	.253	.286	.254	.260

Notes: The dependent variable for all four models is the level of disaster-coping collective efficacy. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 6. Hierarchical linear regression predicting community resilience across the four ethnic groups

	White β	Black β	Hispanic β	Asian β
Constant	-	-	-	-
Block I				
Gender	-.075	.103	.042	-.244**
Age	.163	.042	-.015	.028
Education	.125	-.163	.064	-.026
Income	-.084	.025	.134	.014
Residential tenure	-.012	-.038	-.195	.078
Homeownership	-.217	.087	-.205	-.114
Immigrant status	-.031	-.192	-.127	.063
R^2	.070	.089	.132	.097
Block II				
Local media connection	.016	.004	-.312	.066
Social media connection	.144	-.047	.340*	.210*
Interpersonal connection	.389**	.161	.214	.107
Org connection	.185	-.070	.182*	.148
Gov and EM connection	.244*	.568***	.059	.420**
R^2	.333	.436	.325	.314

Notes: The dependent variable for all four models is the level of community resilience. * $p < .05$, ** $p < .01$, *** $p < .001$.

Hispanic residents, however, such communication was not significantly related to any disaster-coping outcome.

Discussion

Using a community sample, the current study examines how disaster communication ecology, which consists of media, interpersonal, and organizational communication resources, are utilized by diverse community members to navigate post-disaster recovery. The following findings emerge from the current analysis. First, the study confirms the positive link between disaster communication ecology and residents' coping outcomes, including self-efficacy, collective efficacy, and community resilience. Second, rather

than assuming a unified disaster communication ecology for all community members, findings identify a substantial ethnicity-based divergence both in terms of the varying levels of connection to communication resources and the specific type of resources that most effectively assist each group of residents in coping with a disaster.

It is worth noting that within the same communication ecology, specific communication resources are more effective than others. Among the five types of communication resources, interpersonal connection and government, EM communication are the two most consistent predictors of all residents' self-efficacy, collective efficacy, and community resilience perception. In contrast, local media is least associated with those outcomes. The minimal effect of local media is consistent with what Spialek et al. (2016) found in their study of Illinois communities affected by tornadoes. The researchers attributed such a finding to the lack of sustained media coverage as well as the absence of local media outlets in the communities under study. In the current context, although there was an abundance of local media covering Hurricane Harvey during and immediately after the disaster (Stelero, 2017), the follow-up coverage—especially those regarding disaster relief and community re-building—remained scarce. As many empirical studies suggest, the media's role in disaster and emergency management has been largely limited to the disaster response phase. The post-disaster coverage, even if available, tends to be "basic, limited, and occasionally contradictory" (Asgary & Ayvaziankari, 2013, p. 1). Therefore, the lack of quality post-disaster media narrative may be directly responsible for the non-significant relationships identified here.

Besides interpersonal and official EM communication, residents' connection to local organizations is significantly associated with disaster-coping self-efficacy and community resilience. This finding confirms the significant role of community-based organizations in disaster coping and post-disaster community building. During Hurricane Katrina and Rita, for example, local churches and community groups were found to serve the disenfranchised groups the best, as these groups were often beyond the outreach of formal disaster response systems (Joshi, 2010). Meanwhile, current findings also suggest that diverse residents are not equally integrated into a community's organizational infrastructure. Specifically, Asian residents have a significantly lower level of organizational connections. In contrast, Hispanic residents are most connected to local organizations and able to translate such connections into greater disaster coping self-efficacy.

In terms of which type of communication resources best predict disaster coping outcomes among each ethnic group, the current findings point to opportunities as well as constraints. For White and Asian residents, government and EM channels are one of the most effective types of communication, but such effects are much weaker for Black or Hispanic residents. In particular, official emergency communication does not predict any disaster coping outcomes among Hispanic residents, and this indicates the possibility that such communication is either less accessible (e.g., language barrier) or less preferred (e.g., mistrust). In fact, relevant studies confirm this pattern by highlighting the centrality of interpersonal communication in Hispanic residents' disaster and risk communication ecology. For example, Gonzalez (2013) finds that family and friends are the top source for Latinas to gather cervical cancer-related health information, and the same channel is heavily relied upon for disaster preparedness (Peguero, 2006). In addition, other work identifies a high level of mistrust of government among Hispanic Americans during emergency management (Wray et al., 2006), which provides

additional explanation regarding the under-utilization of government-citizen communication and the resulting disaster vulnerability among this group.

By contrast, interpersonal communication plays a very marginal role among Asian residents. For this ethnic group, official emergency communication is among the most effective communication resource for disaster recovery. This finding is consistent with Wray et al.'s (2006) study on different ethnic groups' trust perceptions in emergency communication. The study suggests that, compared to other ethnic minorities, Asians are more likely to consider government and first responder agencies trustworthy. Furthermore, the significant effect can be attributed to high power distance, which commonly characterizes Asian cultural values. Such cultural values may encourage respect and conformity to the authority (Hofstede, 2001), leading to greater use of government and official communication sources.

Finally, while previous literature suggests that news media are largely instrumental for disaster coping and recovery (e.g., Tanner et al., 2008), the current study identifies a somewhat counterintuitive finding. That is, news media—including both traditional and social media—are negatively related to one crucial disaster coping outcome among Black residents, disaster-coping collective efficacy. Collective efficacy is the belief that a group, rather than individuals themselves, can effectively solve problems and mobilize resources through concerted effort (Bandura, 1997). Compared to individuals' self-efficacy, one's collective efficacy perception is more likely to be shaped by social processes such as intergroup interaction (Bilali et al., 2017). One possible explanation, therefore, deals with how news media shape group identity and intergroup perceptions among African American residents. Research has long documented the distorted portrayal of African Americans in mass media. For example, Black individuals are more subject to criminalization and racial stereotypes compared to other groups (Dixon, 2006; Mastro & Tropp, 2004). Such representation may lead to reduced trust and a lower level of community belonging among African American residents (Robinson & Culver, 2019). In other words, a higher level of media digest could reinforce the "us versus them" perception, which understandably lowers the confidence of counting on other community members in post-disaster recovery among African American residents.

Theoretical implications for communication ecology

Using the communication ecology concept to understand disaster coping outcomes among diverse communities, the current study offers important theoretical implications for the communication ecology framework. First, the structure and configuration of communication ecology proves to be ethnically bounded. In other words, when navigating natural disasters, how diverse residents construct their resource networks are not the same. Their respective communication ecologies may be shaped by culturally ingrained preferences, as well as how different forms of disaster communication are made available to them. This finding reinforces the idea that ethnicity is an important factor in shaping how individuals conceive and utilize communication resources. It is also consistent with prior findings that residents from different ethnic backgrounds tend to connect to separate, rather than unified storytelling networks (Chen et al., 2013).

Second, although the overall relationship between communication ecology and disaster-coping outcomes are positive, specific communication resources turn out to be more

effective than others. Other than ethnicity-based divergence, such differences may be attributed to the communication context where resource-seeking activities take place. Communication context is found to significantly enhance or constrain the effect of a particular type of communication resource (Kim & Ball-Rokeach, 2006). Other than a neighborhood context, the disaster situation itself constitutes another form of context that can influence how much residents find specific communication resources useful. During health epidemics, for example, media resources may be more heavily relied upon compared to during natural disasters. The interplay between context and communication ecology warrants more future research, considering individual goals, contexts, and communication behaviors are all intertwined.

Limitation and future direction

There are several limitations in the current study that point to directions for future research. First, the quota sampling strategy used for recruitment, though instrumental for cross-group comparison, may not produce a sample representative to the general population under study. Therefore, current findings may not be generalized to the broader spectrum of populations or communities with different characteristics. Second, community-level features, such as demographic heterogeneity, social cohesion, or the presence of formal, informal disaster response networks, are not considered in the current study. Past research has suggested that community context can significantly impact individual members' disaster preparedness and post-disaster resilience (e.g., Cagney et al., 2016), and future research may investigate how communication ecology works in tandem with community-level features to generate various disaster-coping outcomes. Last but not least, as two years have passed since the occurrence of the disaster event, the responses collected may be subject to inaccurate recall or "survivor bias"—the tendency for respondents to overrate their disaster-coping experience. Future research may consider collecting data at different time points, assessing whether and how residents' communication behaviors may evolve as a disaster unfolds.

Conclusion

With more natural disasters arising around the world, it is important to understand how to leverage various resources to assist communities affected by the disaster. Guided by the communication ecology framework, the current study offers an in-depth investigation of how communication resource networks diverge across ethnic lines and how those networks differently facilitate disaster coping among diverse community members. The study highlights the fundamental role of community communication resources, on top of material resources, in cultivating community resilience in the aftermath of a disaster. It also offers practical implications concerning how to better reach and prepare residents from diverse cultural backgrounds to cope with disasters. As communities today are increasingly transformed by demographic shifts, more research is needed to fully unpack the processes and strategies that revitalize communities after disasters.

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Notes

1. Only four racial and ethnic categories were provided in the first screening question. However, it is possible that mixed raced individuals chose to identify with one pre-set category and participated in the survey. Since the study focuses on avowed identity, the self-conceived racial and ethnic identification, the inclusion of mix-raced individuals does not compromise the current results.
2. Immigration status was asked by the question “who in your family first came to the United States.” Those who answered “Me/spouse/sibling” were coded as first-generation immigrants, “Parent/aunt/uncle” were coded as second-generation immigrants, and “Grandparents or great grandparents” were coded as native citizens.

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