Special section: Communication of Socio-environmental Risks and Disasters
v. 67, p. 483-499, Jan./Jun. 2026 http://doi.org/10.5380/dma.v67i.98704 e-ISSN 2176-9109

DMA Desenvolvimento e Meio Ambiente

UFPR Biblioteca Digital de Periódicos BDP | UFPR revistas.ufpr.br

Disasters and community uses of media: how hurricane Maria impacted vulnerable Puerto Ricans

Desastres y el uso de medios de comunicación en la comunidad: cómo el huracán María impactó a puertorriqueños vulnerables

Desastres e uso da mídia na comunidade: como o furacão Maria impactou porto-riquenhos vulneráveis

Manuel CHAVEZ[1], Bruno TAKAHASHI[1]*, Luis Graciano VELAZQUEZ[1], Alexandra BENITEZ[1]

1 Michigan State University (MSU), East Lansing, Michigan, United States of America.

* Contact e-mail: btakahas@msu.edu

Article received on **February 27, 2025**

Final version accepted on **June 26, 2025**

Published on **June 17, 2026**

Abstract: This study examines how vulnerable populations in Puerto Rico experienced and coped with the total collapse of communications infrastructure before, during, and after Hurricane Maria. As power and communication systems failed, residents urgently sought news and information from any available source to protect their lives and property while attempting to understand Maria's impacts. The authors conducted ten focus groups across different regions of the island, employing confirmation bias theory and media dependency theory as analytical frameworks. Findings revealed that analog radio emerged as the sole operational communication system capable of providing information to all segments of Puerto Rican society. The study demonstrates how Maria's catastrophic damage affected the entire population, with disproportionate impacts on the most vulnerable. This research provides novel insights into communities' widespread dependence on digital and electronic formats during major crises.

Keywords: hurricane Maria; Puerto Rico; disaster; infrastructure.

Resumen: Este estudio examina cómo las poblaciones vulnerables en Puerto Rico experimentaron y enfrentaron el colapso total de la infraestructura de comunicaciones antes, durante, y después del huracán María. A medida que perdían sus sistemas de energía y comunicación, se apresuraron a obtener noticias e información de cualquier fuente disponible para proteger sus vidas, propiedad, e informarse sobre los impactos de María. Los autores realizaron diez grupos focales en diferentes zonas de la isla utilizando las teorías del sesgo de la confirmación y la teoría de la dependencia de los medios. Se encontró que la radio analógica se convirtió en el único sistema operativo de comunicación para proporcionar información a todos los segmentos de la sociedad puertorriqueña. El estudio muestra cómo los daños masivos de María afectaron a todos, pero especialmente a aquellos más vulnerables. El estudio proporciona nuevos puntos de vista sobre la dependencia generalizada de la comunidad de los formatos digitales y electrónicos durante una crisis mayor.

Palabras clave: huracán María; Puerto Rico; desastre; infraestructura.

Resumo: Este estudo examina como as populações vulneráveis de Porto Rico vivenciaram e lidaram com o colapso total da infraestrutura de comunicações antes, durante e depois do furacão Maria. Ao perderem seus sistemas de energia e comunicação, elas correram para obter notícias e informações de qualquer fonte disponível para proteger suas vidas e propriedades e se informar sobre os impactos do furacão Maria. Os autores realizaram dez grupos de foco em diferentes áreas da ilha usando as teorias de viés de confirmação e teoria da dependência da mídia. Eles descobriram que o rádio analógico se tornou o único sistema de comunicação operacional para fornecer informações a todos os segmentos da sociedade porto-riquenha. O estudo mostra como os enormes danos causados pelo Maria afetaram a todos, mas especial-

mente os mais vulneráveis. O estudo fornece novas percepções sobre a ampla dependência da comunidade em relação aos formatos digitais e eletrônicos durante uma grande crise.

Palavras-chave: furacão Maria; Porto Rico; desastre; infraestructura.

1. Introduction

In disaster contexts involving natural hazards, social media platforms have been increasingly promoted as primary information sources for communities, emergency personnel, and disaster victims. This dependence on social media during crises was exemplified in 2017 when Hurricane Harvey struck Houston, overwhelming the city's 911 emergency systems with distress calls during the storm. Houston Police Chief Art Acevedo, who has 42,000 Twitter followers, acknowledged that his department utilized multiple social media platforms to communicate with residents, including Twitter, Facebook, Nextdoor, and Periscope Live. Through these platforms, residents could request assistance via comments sections while police could disseminate public information and coordinate rescue efforts (Keen, 2017). Throughout Hurricane Harvey's impact and aftermath, Houston's electrical grid and cellular communications remained operational with minimal disruption, providing the expected reliable information source during a natural crisis.

However, what occurs when a hurricane's impact results in complete collapse of energy systems, information infrastructure, and cellular communications? First responders cannot locate and rescue victims due to communication failures, residents cannot request assistance when needed, families cannot reunite due to communication breakdowns, and entire communities remain isolated without means to assist their residents. Those requiring assistance remain unaware of government protocols and post-storm instructions, unable to access news and information regarding shelter locations, operating hours, food distribution, fuel availability, water supplies, and medical assistance. This scenario materialized in Puerto Rico following Hurricane Maria's 2017 impact, challenging all assumptions regarding new communication technologies' utility during major disasters. While Maria affected all residents, vulnerable Puerto Ricans experienced disproportionate damage and destruction (Bolin & Kurtz, 2018).

Hurricane Maria struck Puerto Rico on September 20, 2017, as a Category 4 storm. Maria traversed the island from east to west, impacting every community across the territory. Despite the island's location within the hurricane-prone corridor of the Atlantic Ocean and Caribbean Sea, civil society organizations, governmental agencies, and communities were unprepared for a storm of such magnitude and comprehensive impact. Thousands became homeless while the island's infrastructure sustained severe damage from catastrophic winds and flooding, including complete loss of electricity and Internet communications (Ferré-Sadurní & Ramzy,

2017). Rural communities in Puerto Rico's central mountain range lacked electricity for nearly one year, with mortality rates continuing to rise due to inadequate disaster response (Fernández Campbell, 2018).

This study examines how Puerto Ricans experienced and managed the complete collapse of communications infrastructure during and after Hurricane Maria's landfall. As the island lost power and communication systems, Puerto Ricans urgently sought news and information from any available source to protect property and lives while attempting to comprehend Maria's impacts. As the hurricane crossed the island and electrical and cellular connections failed, analog radio emerged as the sole operational communication system providing news and information (Nieves-Pizarro et al., 2018; Takahashi et al., 2020). This study complements existing research on media consumption during crisis situations, particularly under conditions involving substantial communication infrastructure damage (Sood et al., 1987). It specifically examines how vulnerable Spanish-speaking U.S. citizens residing in Puerto Rico mobilized to support their communities. Research addressing both areas remains limited.

2. Literature review

2.1. The Puerto Rican Context

Despite its relatively small territory housing approximately 3.4 million inhabitants, Puerto Rico maintains 141 radio stations (71 AM and 70 FM), five daily newspapers, five weekly publications, approximately twenty regional outlets, over 30 print and online publications, and 20 local public, commercial, and religious television channels (Subervi-Vélez et al., 2022). However, the financial crisis affecting Puerto Rico for over a decade has significantly impacted the island's media industry. Capital investment, including advertising revenue, has decreased substantially in traditional media outlets, resulting in media closures and widespread layoffs (Subervi-Vélez et al., 2022).

In 2016, one year before Hurricane Maria, seven cellular providers operated in Puerto Rico: AT&T, Claro, T-Mobile, Sprint, Open Mobile, Choice Communications, and TracFone Wireless. The territory maintained 3.39 million cellular subscribers, though subscriber distribution data among providers remains unavailable. Evidence suggests that Mexican company Claro commanded greater market share than American providers before Hurricane Maria (PR Newswire, 2016).

AT&T advertised uniform 4G LTE coverage throughout the island according to its website. Immediately following the storm on September 19, 2017, Claro maintained coverage across most of Puerto Rico, particularly in urban centers and coastal regions, with weaker signals in central and rural areas. T-Mobile, TracFone, and Sprint demonstrated similar coverage pat-

terns – robust in urban areas but limited in interior rural regions, though Sprint and TracFone provided marginally better coverage in the island's eastern sector. Open Mobile's coverage concentrated primarily in San Juan and surrounding municipalities, with additional coverage in major cities but sparse availability elsewhere (PR Newswire, 2016).

Puerto Rican broadcasters bear responsibility for transmitting the state/local Emergency Alert System (EAS), which the National Weather Service (NWS) employs to warn the public about local weather emergencies (Federal Emergency Management Administration, FEMA) (Giménez-Porrata, 2010). The NWS originates national and state EAS messages through weather teletype and NOAA Weather Radio; subsequently, WKAQ-AM-FM (Univision Radio) transmits information to participating broadcasters (Giménez-Porrata, 2010). For efficient operation, radio stations maintain power generators and rely on Internet service providers and technicians for equipment maintenance (Rodríguez-Cotto, 2018). Consequently, radio functions as a communication hub facilitating cooperation between local officials and affected citizens (Hindman & Coyle, 1999). However, while media outlets attempt to transmit official government information during disasters (Sood et al., 1987), radio communication dynamics during emergencies can differ significantly from non-disaster contexts. For instance, the blackout and communications collapse caused by Hurricane Maria challenged verification protocols and routine practices, as journalists relied on citizen accounts of ongoing emergencies and official recovery information (Nieves-Pizarro et al., 2018).

Confirmation bias provides a theoretical framework for understanding media use during major disasters. This model's primary assumption posits that when major disasters are announced, most individuals seek information from trusted sources. Furthermore, confirmation bias theory suggests a tendency to evaluate information based on pre-existing beliefs, gravitating toward information consistent with established mental frameworks. In natural disasters, this phenomenon may manifest differently, as information can vary substantially across sources (Allahverdyan & Galstyan, 2014).

Research supports the assumption that information abundance challenges individual beliefs by creating discomfort and cognitive dissonance, motivating avoidance of attitude-challenging information and messages (Allahverdyan & Galstyan, 2014). This pattern appears particularly pronounced in political contexts, where confirmation bias aligns with political ideology, leading some individuals to avoid contradictory news media; however, other research suggests sufficient exposure to counterarguments gradually erodes bias and facilitates belief reassessment (Knobloch-Westerwick et al., 2015). Similar dynamics may occur during natural disasters that challenge safety beliefs and contest overconfidence and complacency.

Research indicates confirmation bias may correlate with media use preferences. Individuals who frequently access online news and encounter

multiple information sources demonstrate reduced information bias, while those with infrequent use exhibit greater confirmation bias (Westerwick et al., 2017). This pattern likely emerges because frequent online information users experience greater diffusion and incidental exposure to counterarguments, while infrequent digital source users rarely encounter perspectives challenging their preferred sources (Knobloch-Westerwick & Kleinman, 2012).

Initial attempts to apply confirmation bias research to disasters emerge through examining weather prediction attention patterns. Research indicates that when presented with forecasts involving probability, risk, and uncertainty, general populations tend to select seemingly simpler, more comprehensible options. This research demonstrates a tendency to gravitate toward easily understood information that resonates more readily and ultimately proves actionable (Shao, 2016; Nicholls, 1999).

Confirmation bias in climate change risk perception can be explained through cultural familiarity frameworks. Stories framed within familiar contexts tend to convey messages more effectively. This applies to climate change communication, where general populations connect better with "culturally congruent narratives" – information articulated in local vernacular proves more effective (Jones & Song, 2014).

2.2. Information seeking during disasters

The Washington Post documented an exemplary case of social media's disaster utility in reporting how Houston residents became autonomous information agents during Hurricane Harvey (Sullivan & Holley, 2017). As Houston residents utilized social media to request flood assistance, volunteers monitored platforms for rescue requests and contacted boat owners using Google Maps coordination. This social media shift resulted from overwhelming 911 call volumes during flooding, causing emergency system overload. Houston residents received instructions to call only in life-threatening situations. The intact power grid enabled continued phone and laptop communication, contrasting sharply with Puerto Rico's experience.

Generational differences in information source and communication channel utilization represent another crucial consideration. Recent research explored how social media habits and crisis media use differ generationally using Swedish national survey data on news source preferences (Ghersetti & Westlund, 2018). Respondents aged 16-85 were analyzed along young/old and contemporary/traditional media axes. Findings revealed older generations utilize traditional media more frequently, while younger demographics gravitate toward contemporary platforms including social media. These patterns extend to both routine and crisis-period media consumption.

Park and Avery (2018) similarly examined audience media use during crises. Their study employed 454 volunteer participants responding to

surveys about information-seeking preferences across disaster types (e.g., public health, severe weather, terrorism). Most participants prioritized television news over other media across crisis types. Researchers concluded broadcast news was preferred during immediate danger situations, while non-urgent scenarios saw increased popularity of alternative communication forms. Age influenced preferences, with younger demographics seeking more online information. Website and social media users demonstrated lower compliance with crisis response instructions compared to traditional media consumers (Park & Avery, 2018). Study limitations included hypothetical situation use, external participant influences, and inability to establish causality. Nevertheless, these findings merit further investigation under actual crisis conditions, particularly regarding population vulnerability and age factors.

Radio use during disasters has received limited recent research attention. Given the emphasis on age-based new technology adoption, attention focuses on how responsible agencies disseminate news and information during disasters. One constant remains: significant impacts on communication and energy systems elevate traditional media as *de facto* information mechanisms. For example, rapid assessment following a New South Wales, Australia storm examined communication patterns during and after the event. Infrastructure damage during the storm elevated radio's importance over television for communication purposes. Despite radio's importance, emergency radio station awareness remained low (23%), with less than half of households possessing battery-operated radios (Cretikos et al., 2008). Puerto Rico experienced similar conditions, with residents facing battery shortages.

Post-Maria, Puerto Ricans accessed information exclusively through battery-operated radio receivers unless they possessed home generators enabling Internet connectivity. Some utilized vehicles for radio news access, though gasoline restrictions led most to use car batteries for receiver power. While radio remains an important disaster information source, power and communication system disruptions affecting residents limit their ability to communicate needs, shifting their experience toward passive audience roles. This aligns with radio's historical unidirectional communication role (excepting Puerto Rican cases where generator-powered landlines or communication devices enabled calling). Additionally, the Puerto Rican diaspora in the continental United States accessed online broadcasting stations (e.g., Facebook Live) and interacted with media – impossible on the island – creating interesting communication triangulation. Island residents and diaspora members interacted with identical media through vastly different modalities. Puerto Rican listeners accessing radio stations via online broadcasts or social media tools actively participated in condition updates and information sharing. Diaspora audiences called to gather information about loved ones or offer relief assistance. These dynamics among social

systems, media, and audiences constitute fundamental components of media dependency theory (Ball-Rockeach, 1985). The theory posits that social instability contexts increase dependence on particular communication media, thereby amplifying potential media influence.

3. Research questions

Based on the preceding discussion, this study poses the following research questions focusing on Puerto Rico's vulnerable populations:

Research question 1: What media types and information sources did Puerto Ricans utilize before, during, and after Hurricane Maria's impact?

Research question 2: What factors explain media and information source utilization patterns before, during, and after Hurricane Maria's impact?

4. Methods

Collecting information about traumatic events from firsthand witnesses provides reliable data due to strong memory formation – experiencing disasters creates lifelong imprinted memories (Rubin et al., 2008). An important consideration for post-disaster interview reliability involves participants' cognitive recall nature and its effects on memory fidelity. Powerful emotions strongly influence how individuals remember and recount experiences following traumatic incidents; individuals commonly maintain clear memories of lived experiences that become recurrent and persistently present (Rubin et al., 2008). These intrusive traumatic memories remain fresh with minimal distortion, persisting in participants' minds; without adequate outlets for anecdotal expression, memories continuously cycle (Dalgleish et al., 2008).

When intrusive memories receive self-expression opportunities, particularly in emotionally supportive settings, memory recall becomes more effective than in neutral states (Ferree & Cahill, 2009). Research on major traumatic events anticipates that interviews produce precisely such effects on participants' traumatic experiences. Focus groups' collective nature provides appropriate emotional bonding venues, as shared experiences help participants connect mutually. Memories become reinforced and clarified through detail recollection and emotional state reconstruction (Ferree & Cahill, 2009).

Understanding technology preferences and uses requires direct interviews with event survivors. In-depth interviews and open-ended questions facilitate studying technology utilization patterns, timing, duration, and user demographics. Researchers conducted 10 focus groups across five Puerto Rican cities during two weeks in 2018, totaling 83 participants, with two additional focus groups in 2023. Focus groups targeted two vulnerable population types: economically disadvantaged individuals defined by

poverty levels, and elderly persons whose age creates clear disadvantages. Interviews occurred in Hurricane Maria's most affected areas within community spaces including schools, community centers, and residences. This approach provided access to disaster survivors while situating research in heavily impacted environments.

Research sites included *Yabucoa* and *Humacao* – low-income, high-unemployment communities experiencing significant infrastructure damage. The *Barranquitas* community represented isolated central highlands suffering prolonged road and housing damage. The cities of *San Juan* and *Bayamón*, which are part of the capital's metropolitan areas, were also included, where demographic disparity and the vulnerable population provide a perspective on how the population faced the storm and its consequences. The 2023 focus groups occurred in Isabela, located in the island's northwest region.

Focus groups were selected for their unique qualitative advantages. They provide rich information through collective social and behavioral experiences, making them ideal for investigating community disaster experiences (Hesse-Biber & Leavy, 2010). Furthermore, focus groups facilitate identifying community perspectives while exploring research themes through open discussion, often revealing resilience and collective effort (Lindlof & Taylor, 2017). Groups included elderly public assistance recipients, retired seniors, unemployed young adults, employed adults, and unemployed university students. The research team additionally conducted San Juan interviews with Federal Emergency Management Agency (FEMA) officials (n=2) and community members (n=6) who declined focus group participation but agreed to individual interviews.

Semi-structured interviews followed question scripts aligned with confirmation bias and media dependency theories. Researchers asked participants: What information types did you seek before, during, and after the disaster? Which news and information sources did you trust before, during, and after the storm? How did you access information sources during and after Hurricane Maria's impact?

Focus groups were video and audio recorded, then transcribed for qualitative analysis. One researcher maintained observational notes throughout sessions. The study employed an inductive approach identifying emergent themes regarding disaster media experiences and format preferences. Two coders analyzed interview transcripts qualitatively. Following initial inductive analysis, primary codes were recoded and grouped according to previously described conceptual and theoretical considerations.

Thematic analysis identified patterns and key themes within interview and focus group data. This methodological approach, supported by Braun and Clarke (2006) and Guest et al. (2012), enables structured interpretation and description of qualitative data, facilitating theoretical model construction and practical problem-solving. Through iterative coding processes, rel-

evant themes were identified and defined within texts, incorporating memo creation and term mapping techniques. Regarding validity, external validity evaluates finding generalizability while internal validity measures inter-researcher consensus. This study utilized internal validity principles to design open-ended questions enabling consensus in analyzed data.

5. Results

Puerto Rico's media organizations maintained full awareness of Hurricane Maria's potential impacts. Newsroom personnel and broadcast meteorologists prepared comprehensive information packages alerting Puerto Ricans to storm dangers (Takahashi et al., 2020). However, Hurricane Irma threatened the island two weeks before Maria's arrival, originally expected to make direct landfall. Ultimately, Irma veered north by 60 miles, causing minimal damage. As Maria approached Puerto Rico, collective hope persisted that the new storm would similarly bypass the island:

> *We hoped the storm wouldn't hit us. The island has been saved from Mother Nature many times, so we were almost certain this would be the case with Maria. Irma was two weeks before and moved away, so there was general hope that the new storm would turn. (Participant 6-8).*

Four days before Maria's arrival, all radio and television stations began warning Puerto Ricans about high probabilities of direct impact with increasing storm categories approaching the U.S. Virgin Islands. Preparation recommendations filled weather reports and news segments throughout regular programming. Four days of preparation time revealed generational preferences for specific information sources. Young university students and unemployed individuals predictably utilized Internet social networking sites for information gathering:

> *I started checking Facebook and Twitter about the hurricane and shared that information with my parents. They already knew, but I thought my information was more up-to-date than theirs. My friends and classmates communicate with each other through Facebook and shared how their own families were preparing for the storm. We weren't afraid, we thought it was going to be a minor hurricane. (Participant 5-8).*

Adults with young families used social media, but their main source of information before María struck Puerto Rico was television at home and radio while commuting to work. Participants acknowledged adequate and timely information provision for Maria preparation. Certain elements remained unclear, including storm intensity, speed, and precise landfall timing and location. Older adults and elderly participants similarly depended on radio and television as primary news sources; few university-educated individuals checked social media and Internet for specific information from

National Oceanic and Atmospheric Administration (NOAA) and National Hurricane Center websites:

> *Before the storm entered Puerto Rico, I watched Channel 2 (Telemundo) and Channel 4 (WAPA TV) and compared their information. I was looking for who (meteorologist) was giving the information and who had the most recent updates and predictions of the hurricane's path. They did a good job keeping us informed as the storm approached Puerto Rico. By then we already knew the storm would be strong from the damage it caused in the U.S. Virgin Islands. Every day when I went to work, I listened to the radio as they were giving information that seems different from what television gives. (Participant 9-7).*

These consistent responses across most focus groups clearly demonstrated generational variations influencing preferred news and information sources before Hurricane Maria's impact. Older individuals demonstrated greater comfort utilizing television and radio as primary news and information sources. This supports media dependency theory's proposition that crisis situations drive individuals toward preferred media for information access (Ball-Rockeach, 1985). Most participants accessed and trusted familiar, reliable radio and television stations, closely following confirmation bias propositions. News and information access correlated strongly with technological familiarity and comfort levels. Most individuals experienced no difficulties with radio and television, but social media and Internet navigation required specific skills for site usage and content searching. Regardless of gender, participants under 35 demonstrated high familiarity with smartphones, tablets, and computers for news and information searching.

The challenge for most Puerto Ricans emerged when Maria's passage caused catastrophic damage to communications and electrical infrastructure. With sustained winds reaching 155 miles per hour and storm width exceeding Puerto Rico's dimensions, the hurricane impacted the entire island, causing landslides, flooding, and three tornadoes. Electricity failed almost simultaneously with Maria's landfall, and cellular coverage collapsed within hours, leaving Puerto Ricans without means to understand ongoing events, damage magnitude, or the welfare of family, neighbors, and friends. Communication collapse prevented first responders from answering emergency calls made through surviving landline phones. By September 20, 2017's evening, no news or information remained available through social media and television; only analog radio (station WKAQ) transmitted weak signals using power generators. While other stations continued Internet broadcasting, analog transmission resumed 2-3 days post-storm.

Participants' responses illuminated information source utilization during the storm. Most participants became emotional describing their experiences obtaining news and information:

> *We were completely in the dark, literally. Without electricity and without cell phones, we couldn't know where things were. We didn't know the damage, we didn't know*

> *when the power would come back, we didn't know how our families were, nothing. It was very sad. (Participant 4-7).*
>
> *The only thing that worked was the radio. I had a radio with new batteries and I could learn the size of the damage. I shared the information with my family and my neighbors. That's when I realized that some of my neighbors didn't have radios or batteries, and in a way, I was the one sharing the information, then those neighbors passed it on to others. (Participant 4-9).*
>
> *State emergency services were useless. Their communication system collapsed, the Control Center flooded, their satellite radios didn't work because the cloud density was so thick they couldn't communicate. Plus, they didn't even know where to go. The Governor couldn't communicate with the mayors, imagine that. (Participant 6-3).*

Days after the storm passed and Puerto Ricans collectively began recovery processes, persistent electricity and cellular communication failures highlighted modern societies' fragility. Critical information needs included family welfare across the island and notifying U.S.-based relatives of their safety. Additional needs encompassed normalcy timelines, electricity restoration, gasoline/water/ice availability, and bank branch operations and hours. Notably, ATM networks collapsed, and non-functional credit card terminals made cash the sole payment method. As days became weeks, Puerto Ricans continued relying on radio as their primary news and information source. Since local Puerto Rican broadcasters, excepting WAPA Radio, could not transmit internally, they provided normal programming via Internet to diaspora audiences, who subsequently informed island families through sporadic landlines or cellular connections. Communication became triangular: information transmitted online to diaspora members who relayed updates to island families.

Focus groups explored post-hurricane information source utilization. One participant clearly articulated radio's important role. During disasters, most individuals return to familiar, trusted, reliable sources. This characterized Puerto Rican radio station usage, as expressed by the participants:

> *I couldn't know anything about what was happening in Puerto Rico. When I drove to get ice or gasoline, I tuned into the radio and learned a little more, but remember we couldn't have the car running all the time to listen to the radio. Gasoline was rationed and hard to find, I really depended on my neighbor to learn from his radio that worked with a small generator. (Participant 5-12).*

Post-storm recovery complexity increased with persistent power and communication failures, creating significant first responder challenges. Neighbors expressed concern for acquaintances in unprotected areas or structurally inadequate housing. Other concerns involved isolated elderly poor lacking resources for food, water, and medication access. These conditions mobilized community assistance for disadvantaged neighbors, again

relying on radio for safe travel information. Communities transformed into active social networks conducting door-to-door welfare checks:

> *When I knew it was safe to go out, I was looking for the elderly woman who lives alone at the end of the street. When I found her, I immediately realized she needed food, water, and insulin. I provided some help, but called the radio station to ask for help. I gave the address and my information, and to my surprise a community organization arrived in a couple of hours to help the elderly woman. And so I saw more examples. Yes, I know my house flooded, but it's still there. Others, especially the elderly and poor, lost everything. (Participant 6-9).*

6. Discussion

Persistent poverty represents a widespread condition in disasters causing disproportionate negative impacts (Hartman & Squires, 2006; McEntire, 2007). Hurricane Maria devastated Puerto Rico entirely, but vulnerable populations suffered greater losses. While local and state officials treated storm information seriously, traditional media dissemination failed to reach many disadvantaged groups consistently. Inequality manifested through equipment deficiencies (cellular phones, computers, tablets, Internet access) and even basic electricity access among these groups. Many focus group participants witnessing these disproportionate impacts on truly disadvantaged Puerto Ricans reported profound helplessness and loss.

Puerto Rico's complete electricity and communication system failure rendered most crisis information mechanisms useless. Communication system loss eliminated first responder coordination mechanisms. No information sources enabled state and local authorities to assess Maria's damage location and extent. Many focus group participants blamed government unpreparedness for Hurricane Maria's impacts, while others argued the unprecedented impacts precluded adequate preparation. Puerto Ricans utilized any available mechanism for gathering critical news and information regarding medication preservation (ice requirements), gasoline/water/food purchases, bank branch cash access, and work resumption timing. Some participants acknowledged Puerto Rico's lowered guard and subsequent testing by Maria. Even by February 2019, two years post-Maria, approximately 85% of infrastructure had been restored.

Nicholls' (1999) work attempted to explain bias consequences. Our research reveals these effects in participants' narratives regarding how weather report uncertainty affected their recommendation response capacity. Terms like "disbelief" and "overconfidence" commonly characterized responses to reports and forecasts, with genuine action occurring only as weather deteriorated.

Based on Nicholls' (1999) findings, we argue confirmation bias influences participants' future weather report attitudes. Interestingly, study du-

ration observations revealed most participants now demonstrate increased involvement and information awareness. Participants diversified their information reception media and ensured multiple backups preventing communication disruptions. This relates to climate change studies arguing that populations directly experiencing adverse weather effects develop heightened awareness of future climate risks (Shao, 2016). Focus group participants expressed diligent preparation for upcoming storm seasons and proactive provisioning when danger approaches.

Analog radio emerged as the primary information source during and after Hurricane Maria's passage. Social media failed to provide the promoted mechanisms for assisting individuals and communities facing disasters. Young Puerto Ricans accustomed to social media as primary information sources discovered their familiar communication media became useless as power and cellular coverage collapsed. Young adults discovered news and information could be reliably provided through alternative sources. Older Puerto Ricans dependent on traditional television media realized electricity loss prevented information access. Young, middle-aged, and elderly Puerto Ricans depended on radio for weeks, months, and nearly one year in mountainous regions.

Puerto Ricans before, during, and after the storm relied directly on familiar, trusted information sources, whether radio, television, or Internet. They relied on specific stations where preferred forecasters provided information; many respondents within identical focus groups disagreed about Puerto Rico's most accurate weather forecaster. This demonstrates confirmation bias propositions that individuals gravitate toward trusted sources. We identified a resonant theme when participants revealed that local broadcasters and independent meteorologists represented their most trusted, reliable information sources. Sources closest to home, speaking their language and easily identified as community members, proved easier to hear and more persuasive regarding shelter, preparation, and general storm readiness (Hore et al., 2018).

We observed clear, consistent, well-tracked cognitive recall regarding Maria's Puerto Rico impact. Participants experiencing the major disaster maintained clear, descriptive memories of Maria's devastation, especially during immediate recovery when communities and neighborhoods mobilized mutual assistance. Previously non-interactive neighbors united to help one another, then mobilized collectively to assist severely affected nearby residents. Their memories remained fresh from the so called *storm of the century*.

This belonging reveals another confirmation bias link – creating bonds and familiarity within general populations. When disasters affect entire populations, everyone shares the experience, creating trauma-based bonding that unites groups into new in-groups, increasing favorable mutual perceptions (Vezzali et al., 2015). Our study observed this reasoning through-

out. Populations experiencing Maria together became more united than ever, increasingly willing to help and consider neighbors not as strangers but as humans requiring assistance.

This research contributes to disaster communication literature examining periods before, during, and after major storms impact populated areas. As emergency agencies increasingly depend on digital systems and social networks for crisis community assistance, Puerto Rico's experience exemplifies the necessity for alternative plans incorporating seemingly obsolete technologies like analog radio. Examining whether other disaster-vulnerable geographic areas have prepared emergency protocols emphasizing non-cellular, non-electric communication technologies remains critically important.

Acknowledgements

This research was funded by the National Science Foundation (grant number 1824976); Division of Civil, Mechanical and Manufacturing Innovation.

References

Allahverdyan, A., & Galstyan, A. (2014). Opinion dynamics with confirmation bias. *PLOS ONE, 9*(7), e99557. https://doi.org/10.1371/journal.pone.0099557

Ball-Rokeach, S. J. (1985). The origins of individual media-system dependency: A sociological framework. *Communication Research, 12*(4), 485-510. https://doi.org/10.1177/009365085012004003

Bolin, B., & Kurtz, L. C. (2018). Race, class, ethnicity, and disaster vulnerability. In H. Rodríguez, W. Donner, & J. Trainor (Eds.), *Handbook of disaster research* (pp. 181–203). Springer. https://doi.org/10.1007/978-3-319-63254-4_10

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Cretikos, M., Eastwood, K., Dalton, C., Merritt, T., Tuyl, F., Winn, L., & Durrheim, D. (2008). Household disaster preparedness and information sources: Rapid cluster survey after a storm in New South Wales, Australia. *BMC Public Health, 8*, Article 195. https://doi.org/10.1186/1471-2458-8-195

Dalgleish, T., Hauer, B., & Kuyken, W. (2008). The mental regulation of autobiographical recollection in the aftermath of trauma. *Current Directions in Psychological Science, 17*(4), 259-263. https://doi.org/10.1111/j.1467-8721.2008.00586.x

Fernández Campbell, A. (2018, August 15). *Puerto Rico power restored 11 months after Hurricane Maria*. Vox.

Ferré-Sadurní, L., & Ramzy, A. (2017, September 20). *Hurricane Maria makes landfall on Puerto Rico as residents seek refuge*. The New York Times.

Ferree, N. K., & Cahill, L. (2009). Post-event spontaneous intrusive recollections and strength of memory for emotional events in men and women. *Consciousness and Cognition, 18*(1), 126-134. https://doi.org/10.1016/j.concog.2008.11.008

Giménez-Porrata, A. (2010). *Puerto Rico emergency alert system state EAS plan*. https://www.fcc.gov/file/13186/download

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. SAGE Publications. https://doi.org/10.4135/9781483384436

Ghersetti, M., & Westlund, O. (2018). Habits and generational media use. *Journalism Studies, 19*(7), 1039-1058. https://doi.org/10.1080/1461670X.2016.1254061

Hartman, C., & Squires, G. (2006). *There is no such thing as a natural disaster: Race, class, and Hurricane Katrina*. Routledge.

Hesse-Biber, S. N., & Leavy, P. (2010). *The practice of qualitative research*. SAGE Publications.

Hindman, D. B., & Coyle, K. (1999). Audience orientations to local radio coverage of a natural disaster. *Journal of Radio Studies, 6*(1), 8-26. https://doi.org/10.1080/19376529909391705

Hore, K., Kelman, I., Mercer, J., & Gaillard, J. (2018). Climate change and disasters. In H. Rodríguez, W. Donner, & J. Trainor (Eds.), *Handbook of disaster research* (pp. 257–280). Springer.

Jones, M., & Song, G. (2014). Making sense of climate change: How story frames shape cognition. *Political Psychology, 35*(4), 447-476. https://doi.org/10.1111/pops.12057

Keen, A. (2017). *How one of America's most powerful policemen learned to love social media after Hurricane Harvey*. TechCrunch. https://techcrunch.com/2017/11/12/how-one-of-americas-most-powerful-policemen-learned-to-love-social-media-after-hurricane-harvey/

Knobloch-Westerwick, S., & Kleinman, S. B. (2012). Preelection selective exposure: Confirmation bias versus informational utility. *Communication Research, 39*(2), 170-193. https://doi.org/10.1177/0093650211400597

Knobloch-Westerwick, S., Mothes, C., Johnson, B. K., Westerwick, A., & Donsbach, W. (2015). Political online information searching in Germany and the United States: Confirmation bias, source credibility, and attitude impacts. *Journal of Communication, 65*(3), 489-511. https://doi.org/10.1111/jcom.12154

Lindlof, T. R., & Taylor, B. C. (2017). *Qualitative communication research methods* (4th ed.). SAGE Publications.

McEntire, D. A. (2011). Understanding and reducing vulnerability: From the approach of liabilities and capabilities. *Disaster Prevention and Management, 20*(3), 294–313. https://doi.org/10.1108/09653561111141736

Nicholls, N. (1999). Cognitive illusions, heuristics, and climate prediction. *Bulletin of the American Meteorological Society, 80*, 1385-1398. https://doi.org/10.1175/1520-0477(1999)080<1385:CIHACP>2.0.CO;2

Nieves-Pizarro, Y., Takahashi, B., & Chavez, M. (2018). La radio y sus oyentes durante el huracán María: Un reexamen de la relación medio-audiencia en situaciones de desastres. *Intersecciones, 2*.

Park, S., & Avery, E. J. (2018). Effects of media channel, crisis type and demographics on audience intent to follow instructing information during crisis. *Journal of Contingencies and Crisis Management, 26*(1), 69-78.

PR Newswire. (2017, 08 noviembre). *Puerto Rico – Telecoms, Mobile and Broadband – Statistics and Analyses*. https://www.prnewswire.com/news-releases/puerto-rico---telecoms-mobile-and-broadband---statistics-and-analyses-300552411.html

Rodríguez-Cotto, S. (2018). *Bitácora de una transmisión radial*. Trabalis Editores.

Rubin, D. C., Boals, A., & Berntsen, D. (2008). Memory in posttraumatic stress disorder: Properties of voluntary and involuntary, traumatic and nontraumatic autobiographical memories in people with and without posttraumatic stress disorder symptoms. *Journal of Experimental Psychology: General, 137*(4), 591–614. https://doi.org/10.1037/a0013165

Shao, W. (2016). Are actual weather and perceived weather the same? Understanding perceptions of local weather and their effects on risk perceptions of global warming. *Journal of Risk Research, 19*(6), 722-742. https://doi.org/10.1080/13669877.2014.1003956

Sood, B. R., Stockdale, G., & Rogers, E. M. (1987). How the news media operate in natural disasters. *Journal of Communication, 37*(3), 27-41. https://doi.org/10.1111/j.1460-2466.1987.tb00992.x

Subervi-Vélez, F., Rodríguez-Cotto, S., & Lugo-Ocando, J. (2022). *The news media in Puerto Rico*. Routledge.

Sullivan, K., & Holley, P. (2017). *Texans' do-it-yourself rescue effort defines Hurricane Harvey.* Washington Post. https://www.washingtonpost.com/national/texans-do-it-ourselves-rescue-effort-defines-hurricane-harvey/2017/09/02/f41bb8ee-8f2f-11e7-8df5-c2e5cf46c1e2_story.html

Takahashi, B., Zhang, Q., & Chavez, M. (2020). Preparing for the worst: Lessons for news media after Hurricane Maria in Puerto Rico. *Journalism Practice, 14*(9), 1106-1124. https://doi.org/10.1080/17512786.2019.1682941

Vezzali, L., Cadamuro, A., Versari, A., Giovannini, D., & Trifiletti, E. (2015). Feeling like a group after a natural disaster: Common ingroup identity and relations with outgroup victims among majority and minority young children. *British Journal of Social Psychology, 54*(3), 519–538. https://doi.org/10.1111/bjso.12091

Westerwick, A., Johnson, B. K., & Knobloch-Westerwick, S. (2017). Confirmation biases in selective exposure to political online information: Source bias vs. content bias. *Communication Monographs, 84*(3), 343-364. https://doi.org/10.1080/03637751.2016.1272761