# Social Media in Citizen-Led Disaster Response: Rescuer Roles, Coordination Challenges, and Untapped Potential

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**ABSTRACT**

Widespread disasters can overload official agencies' capacity to provide assistance, and often citizen-led groups emerge to assist with disaster response. As social media platforms have expanded, emergent rescue groups have many ways to harness network and mobile tools to coordinate actions and help fellow citizens. This study used semi-structured interviews and photo elicitation techniques to better understand how wide-scale rescues occurred during the 2017 Hurricane Harvey flooding in the Greater Houston, Texas USA area. We found that citizens used diverse apps and social media-related platforms during these rescues and that they played one of three roles: rescuer, dispatcher, or information compiler. The key social media coordination challenges these rescuers faced were incomplete feedback loops, unclear prioritization, and communication overload. This work-in-progress paper contributes to the field of crisis and disaster response research by sharing the nuances in how citizens use social media to respond to calls for help from flooding victims.

**Keywords**

Crisis communication, social media, emergent groups, volunteerism, mobile technology, emergency management

**INTRODUCTION**

Natural disasters often pose an overwhelming demand on first-responders—a demand that cannot always be met by official organizations. Aside from simply not having enough staff to meet the response need, local organizations often find their equipment, structures, and supplies damaged, flooded, or otherwise inaccessible or inoperable. Although some "disaster myths" (Perry & Lindell, 2003) stereotype citizens as helpless victims or prone to panic, disaster evaluations reveal that most victims are saved by fellow citizens (Helsloot & Ruitenberg, 2004). Citizens also form groups to collectively coordinate and help those in need. Whether using the label of "emergent response groups" (Drabek & McEntire, 2003), "emergent citizen groups" (Stallings & Quarantelli, 1985) or the moniker of "informal volunteerism" (Whittaker et al., 2015) citizen-led groups play a clear role in disaster response. Prior research indicates that these groups tend to emerge when citizens feel that demands are not being met by existing organizations (Auf der Heide, 1989). For example, ham radio operators served to transmit information, dispatch ambulances, and coordinate rescues in the wake of the Hurricane Katrina disaster (Majchrzak et al., 2007). During

Hurricane Sandy, citizens used Twitter to alert others to gas shortages, electricity outages, and road closures (Murthy & Gross, 2017).

The citizen-led rescues of flood victims in the aftermath of Hurricane Harvey in Houston, Texas are a recent example of emergent volunteer response. In August 2017 Hurricane Harvey hovered above Houston, TX, dumping record levels of rain on the region. Flood control aqueducts spilled over their banks and flooded 30-40,000 homes in Houston and the surrounding suburbs. This level of flooding was unprecedented, official response varied throughout the area, and thousands of families were trapped in their flooded homes. Multiple city officials and the Federal Emergency Management Agency (FEMA) called for citizens with boats to help rescue people trapped in their homes (Quinn, 2017; Raja, 2017).

Citizens and community groups responded to officials' requests to bring boats and help with the rescue effort. Some citizens operated independently to conduct rescues, while others acted as members of groups like the 'Cajun Navy'—boat owners who travel from surrounding regions to flooded areas and conduct water rescues and/or deliver supplies. The Cajun Navy is not a singular organization. Rather, there are multiple groups operating under the Cajun Navy umbrella. As scholars have noted with similar emergent response groups (see Majchrzak et al., 2007), official membership or affiliation with the Cajun Navy is fleeting. Some individuals may claim membership in the group whereas other individuals are assumed as Cajun Navy because they own a boat and helped conduct rescues. Structures present in The Cajun Navy also mirror findings of previous emergent-response-group research (Drabek & McEntire, 2003) in that leadership is fluid and dispersed, boundaries are unclear, task definitions and assignments are unstable, and contributors are often geographically dispersed. Although membership and boundaries are fuzzy, one thing became clear during the Hurricane Harvey response: mobile communication technologies played a key role in both independent citizens and 'members' of the Cajun Navy's ability to rescue flood victims.

The use of social media and mobile technologies during disasters is not a new phenomenon (Hiltz et al., 2014, Murthy & Longwell, 2013, Reuter & Kaufhold, 2017). A plethora of prior research examines official, top down (Giacobe & Soule, 2014; Hughes & Palen, 2012; Hughes, St. Denis, Palen, & Anderson, 2014; Kavanaugh et al., 2012; Ruggiero & Vos, 2014) and public, bottom up (Starbird & Palen, 2011; White at al., 2014) use of social media during all phases of a disaster life cycle. A majority of the bottom up research focuses on Twitter—a publicly-available data source (David et al., 2016; Hughes & Palen, 2010; Starbird & Palen, 2011; Starbird et al., 2012) and concerns information gathering and dissemination functions.

While Twitter indeed plays an important role during many disasters, the standout social media platforms used to *coordinate* citizen dispatchers with citizen rescuers during the Hurricane Harvey floods in Houston, TX were the Zello walkie talkie app, some new apps developed specifically for Harvey (e.g., CrowdSourceRescue, see Figure 2), Facebook (see Figure 1 of Cajun Navy using Facebook), and a host of other ad hoc platforms.



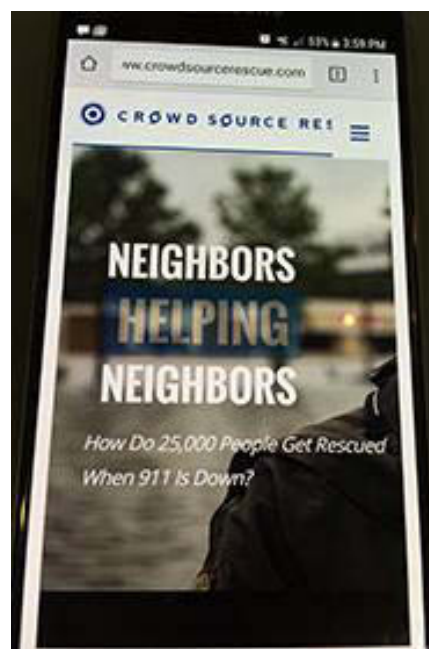**Figure 1: Cajun Navy Facebook (available publicly)**



**Figure 2: CrowdSourceRescue** (available publicly)

Whereas research has examined social media use by officials and the public during disaster, we know less about how emergent groups use mobile communication technologies and social media to coordinate actions during disasters (see Fritze & Kray, 2015 for a notable exception), particularly during flooding. Considering citizens are often the first on scene during disaster, it is important to study how they utilize mobile technologies and social media tools to facilitate response. Thus, our first research question:

RQ1: How do emergent groups use mobile communication technologies and social media to coordinate actions during a wide-scale flood disaster?

Furthermore, it is important to learn the challenges they faced using mobile tools and social media, so those can be addressed in future disasters. Therefore, our second research question is:

RQ2: When social media and mobile communication technologies were used to coordinate actions among volunteer rescuers, what communication challenges emerged?

## METHOD

This study on social media use in citizen-led disaster response groups was conducted as part of a larger project examining the role of social media in posting calls for help during Hurricane Harvey. Eriksson and Olson (2016) claim that, "social media is not a homogenous phenomenon with one coherent role in crisis management and communication research and practice" (p. 205). To that end, we did not focus on one particular social media platform. Instead, we examined the social media technologies used in practice by citizens during the Hurricane Harvey response.

### Data Collection

Participant recruitment started by contacting relief organizations operating in the wake of Hurricane Harvey. Using snowball sampling techniques, our initial respondents referred us to individuals who participated in the rescue effort. These responders were either working on their own, or they were part of a group. One set of our respondents were members of the various 'Cajun Navy' groups. Other respondents were part of groups representing religious organizations, non-profit festival groups, and community groups that sprang up in direct response to Hurricane Harvey. A semi-structured interview guide was used to elicit responses related to the individuals' roles and involvement in volunteer rescues. Questions asked about the participants' motivation for contributing, memorable rescues, decisions to use social media, emotions experienced during rescue, and communication successes/challenges during rescue.

We completed 20 interviews for this analysis of our work-in-progress study (see Table 1 for participant information) that ranged from 31 minutes to over two hours. All interviews were audio recorded for later transcription. The data were analyzed by listening to audio recordings, reviewing field notes, and engaging in team discussions where we followed Owen's (1984) criteria of recurrence, repetition, and forcefulness. Both research questions were answered using this inductive analysis and for research question one, we identified types of social media and the roles rescuers played. Our three core themes and one overarching theme emerged inductively and represent our conceptual categories as we addressed research question two.

Table 1.  Study Participants

| Pseudonym | Age | Role | Association |
|-----------|-----|------|-------------|
| Barbara | 56 | Dispatcher* | Individual |
| Bill | 51 | Rescuer* | Individual |
| Brock | 20 | Rescuer | Community Group |
| Carol | 42 | Dispatcher | Community Group |
| Diana | 44 | Dispatcher | Community Group |
| Harry | 33 | Information Compiler* | Community Group |
| Genevieve | 34 | Information Compiler | Community Group |
| Harriett | 46 | Dispatcher | Cajun Navy |
| Ilene | 62 | Information Complier | Community Group |
| Jade | 31 | Dispatcher | Individual |
| Jake | 47 | Rescuer | Cajun Navy |
| Julie | 40 | Dispatcher & Rescuer | Community Group |
| Kathryn | 47 | Information Compiler | Community Group |
| Mike | 44 | Rescuer | Cajun Navy |
| Olga | 59 | Dispatcher | Individual |
| Rachel | 48 | Rescuer | Community Group |
| Ripkin | 33 | Rescuer | Community Group |
| Sarge | 50 | Rescuer | Cajun Navy |
| Susan | 68 | Dispatcher | Community Group |
| Tucker | 48 | Dispatcher | Cajun Navy |

*Note: The three roles emerged through addressing RQ1*

## FINDINGS

### Research Question 1:  How did citizens use mobile tools and social media?

To address this research question, we first identified the host of specific tools people used during the rescue efforts, but we also found that how they used these tools varied depending on the rescue role they played.

**Specific Social Media Tools**

Using a combination of research on publicly available news and social media sources, as well as through our interviews, these dominant platforms emerged to coordinate citizen response: Zello walkie talkie app—a push-to-talk smartphone application that mimics the functions of a walkie-talkie, Facebook—both public pages and private group sites, NextDoor—a private neighborhood-specific social media platform, and a host of related technologies that were repurposed to organize disaster responses.  For example, Brock, who was involved in volunteer rescues in the greater Houston area and provided clean-up after the flood, stated, "We started a Google Doc where people could post 'I need help' or 'I can help."  We also found that the specific tools groups used were defined by their group and that many new apps emerged during the rescue effort.

**Rescue Roles**

Citizens joined the rescue effort by falling into three different types of roles:  *rescuer, dispatcher*, or *information compiler*.  The visible role that some citizens played was the *rescuer*; these were the people in the water who often were interviewed by the media.  These volunteers came with their boats, found a way to launch their crafts, and physically rescued flooding victims.  The rescuers often had mobile phones with them on their boats. Their use of mobile phones to communicate or access social media varied depending on how busy they were and how much rain was present during the rescue. Many of these volunteers reported having to purchase new mobile phones after the rescues because their devices were damaged by the rain and flood waters.

The next role, vital for the success of the rescues, was what we call the *dispatcher*.  These people stayed behind the

scenes, often by choice, but still wanted to help the rescue effort. They sat behind computers, and/or mobile devices, in dispersed locations and physically used rescue-related platforms. These behind-the-scenes rescuers performed valuable activities: managing a fairly organized rescue-system platform, searching multiple social media platforms for people who said they needed help, taking phone calls from rescuers in the field, finding updated weather and road conditions online, and trying to update information that could help other people in the rescue effort. For example, one volunteer rescuer, not affiliated with a specific organized rescue group, Bill, recounted how family members back in Austin, TX 'dispatched' him around Houston:

> "They were on Facebook getting all the information, um, they had Facebook on one screen they had Google maps on the other with road closures and then they started mapping it out and um, so they had information I didn't in the car so they told me where to be."

Jake, also a volunteer rescuer, working with the Cajun Navy, had his wife monitor the Cajun Navy social media page while he conducted rescues in the field.

The third role people played was a behind-the-scenes *information compiler* not directly involved with the rescue effort, but they saw themselves as vital links to information. These information compilers often had neighborhood maps that they shared through private social media platforms like NextDoor or community Facebook pages, and they were adept at finding relevant information like road closures, predicted flooding levels, and statements from officials about the flooding. The more influential information sources had large networks of community members who followed their Facebook pages, or they were regular contributors to NextDoor before the extensive flooding happened. They were not necessarily social media or technology experts, but they could find the valuable information that others needed during the rescue efforts.

### RQ2: Emerging communication challenges when using social media to coordinate actions among volunteer rescuers.

While it is broadly understood that citizen rescues saved many lives in the Greater Houston, Texas area, there were three technological communication challenges that emerged from interviews: *incomplete feedback loops*, *unclear prioritization*, and *communication overload*. Together, these three themes led the volunteer rescuers to feel dissatisfied, but also hopeful for the future. We discuss each of the themes next and end explaining this overarching finding.

#### Incomplete feedback loops

The main feature all the mobile apps used to track rescue status was through the mechanism of marking. For example, a common way this is accomplished on broad social media platforms, like Facebook, is marking one's self as safe. In theory, the marking mechanism was much more sophisticated in the rescue platforms, but a person had to manually update the system and close the feedback loop.

Harriett commented:

> "There were so many rescues happening and so many requests coming in that it was hard for people to know, hard for the rescuers to know if anyone had already gotten to a certain address or not and so there was a lot of repeat. Ya know someone would get rescued but there was no way to know that and so then a different rescuer would go and that person would already be gone."

With a high volume of information coming in it was difficult for both volunteer rescuers and the people being rescued to remember and report back that they were no longer in need of rescue. While conducting rescues from his boat, Mike utilized a particular Facebook feature:

> "Facebook has this thing where they can tag themselves safe or not safe or whatever and uh, we were using that app thing a lot. It would show you several potential locations and we would try to pick an area with a bunch of pins and go to that area and try to hit all those addresses and make sure everybody was out but we found most of em were already gone."

Harriett explained that there were processes in place to close the feedback loop, but they were not always followed. As a dispatcher using the Zello app, Harriett provided the flood victims with a case number to give to the rescuers once on the boat. Once the rescuer had the case number they could mark that particular case as closed. But, in the hustle and bustle of rescues, many flood victims forgot the number entirely, or did not remember to tell the rescuer their case number. Many flood victims and volunteer rescuers' phones were also destroyed by rain or flood water, leaving them no way to contact the dispatcher and close the feedback loop. Or, as Susan noted, "You never knew which boat was gonna pick them up because somebody else could drive by and pick them up too. So it wasn't the best organization." If a boat other than the one dispatched for that specific case number reached the flood victim first, then the feedback loop was often left open.
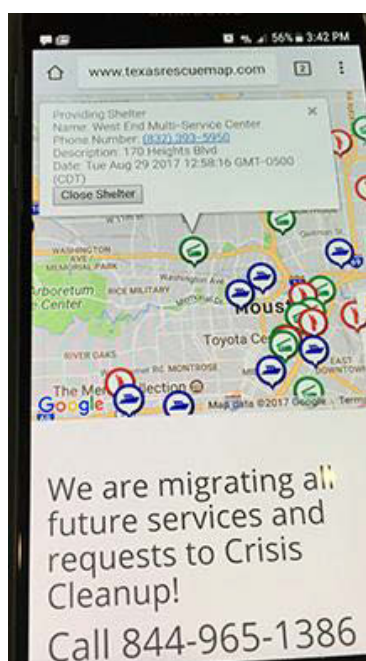
**Figure 3. Screenshot of mobile app created with method to close the feedback loops (shared publicly during the disaster).**

## Unclear Prioritization

A common problem cited by citizen dispatchers and rescuers alike was that there needed to be a way to prioritize certain calls for help. These criteria are established in official response and rescue systems that focus on whether the call is deemed to be life-threatening (Nordberg, 1995) but citizen groups found themselves knowing intuitively that prioritization was needed, but then feeling awkward about enforcing these mushy rules. Indeed, 9-1-1 operators face similarly blurred lines (Nordberg, 1995). For instance, if someone was elderly or injured there needed to be a way for the technology to help the citizen dispatcher indicate the priority of that rescue call:

> "I definitely think that is a point that needs to be addressed if this happens again with this kind of social media rescue kind of thing somebody needs to be in, . . . [short pause] people that are trained to do that need to be in charge of prioritizing calls and assigning." – Harriett

In one case, Harriett needed a rescuer to reach an elderly man who could not easily navigate through the floodwaters. Because Harriett did not have a way to prioritize this call for help, she had to manually cut into conversations on the Zello walkie-talkie app and continually remind the rescuers that the rescue was urgent. This is a clear example of it taking redundant messages to capture the attention of the already overloaded rescuers.

Gary recalled a mother who made an urgent call for help, "she posted, I think on Facebook and Nextdoor, 'water's four feet in our house, we lost power, we moved to the second floor and my son is on a ventilator can someone get us?' and they were rescued finally." There were literally so many messages posted through diverse social media platforms that people were missed, and at times three boats showed up at the same time to rescue the same family.

To overcome the prioritization problems, Brock's group setup a Google Document to collect information:

> "We set up like name, phone number, what you need, and is it immediate?, kind of thing um, and so it gave us a chance to get the information we needed rather than someone just saying 'hey we need help.'"

Although the Google Document allowed Brock's group to indicate priority levels, they were only able to gather this information from flood victims that they spoke to on the phone. Then, there was still the issue of closing the feedback loop when people were actually rescued.

## Communication Overload

It is not surprising that citizens—many not trained to handle the chaos that is normal in an emergency—expressed feelings of being overwhelmed. However, our findings allowed us to identify three primary reasons that volunteer responders felt communication overload: (1) they received too many calls for help at once, (2) when using the Zello app, there was excess radio chatter, and (3) concerned family members called and texted them directly to stay top of their mind.

### Too many to help them all

While Bill was driving his boat rescuing people in the pouring down rain, his family member, acting as a dispatcher,

would text him about urgent messages he found on social media, "I would get endless streams of texts of 'okay there's another person over here that needs help' . . . honestly, they gave me a lot of addresses; I only got to maybe two of them." In addition to the large quantity of information becoming a burden, Bill went on to say that he could not carry out many of the rescues due to flood conditions. His boat needed about two feet of water to float and some neighborhoods had shallow spots preventing him from reaching the other addresses.

Gary recalled, "it became overwhelming just trying to keep track of who was going out who was coming back who was out on a boat, can we account for everyone, and who's in their house and it was a mess."

Jake, a leader of one of the Cajun Navy groups that also helped conduct rescues in Louisiana's 2016 floods, compared the volume of calls for help between the two situations: "it was so many [in Louisiana] you couldn't um, you couldn't answer all of them and during Harvey it was even tenfold that, it was just amazing." The calls for help reached Jake through posts on the Cajun Navy Facebook page wall and private messages sent to the Cajun Navy page. Jake claimed, "the personal messages, there were so many coming in at one time I might click on a message to read it and by the time I read that message I'd done had 15 or 20 more pop up."

*Radio chatter*

In addition to the quantity of calls for help, the Zello App became overloaded with radio chatter.  As Jake put it, "there was just so much chatter online that you couldn't keep up with what somebody started information wise giving somebody, ya know, they'd get bombarded with other people ya know maybe giving addresses of another rescue."

It is important to note that the Zello App was available for download by the public; official emergency responders use private channels and trained dispatchers to streamline their communication.  However, it is equally relevant that by being publicly available, anyone who knew about Zello could make requests, something not possible through official radio channels.

In some instances, citizens who needed to be rescued discovered the Zello App and began using the rescue communication Zello channels to call for help:

> "A lot of civilians that were needing to be rescued they'd go straight to the Zello channel that our rescuers were on and, once again, you had about 40 or 50 of them trying to make rescue requests on there, it kind of hampered our efforts out in the field . . . it was pretty much chaos at that point" - Jake

This overload of data meant that the information was not always received and translated into actionable knowledge.

Eventually, the overload of communications on Zello was partly relieved by dividing up communication channels:

> "There was so much traffic [radio traffic] in Houston they split the Zello group into two different groups, one in Houston, the original one, and one in West Houston" – Bill

> "We learned to make several groups so it would kind of clear some of that up and we wouldn't have so much traffic on each channel." - Jake

*Requests by concerned family members*

Communication overload was not only in the form of direct calls for help initiated by people who were trapped or needed rescue, but many volunteer rescuers were constantly being asked for updates by concerned family members:

> "My parents are very like 'tell me what's going on now' and so like my phone was constantly blowing up from them and it was just like 'we're here, bye, I'll talk to ya'll later' and so that was, I think that was what was hard was some of the responders, they were coming and their families were like 'are you okay, are you okay, are you okay.'"

As Brock's quote illustrates, citizen dispatchers and rescuers responding to disaster are often overloaded with messages from concerned family members. In Brock's case, his parents concerns were likely exacerbated after he used his mobile phone for Zello so much that the battery died. This may be a particular type of communication overload that official sources are not often faced with. For instance, if family members of Police officers, EMS workers, or firefighters are accustomed to their loved ones helping in times of crisis, then the family members may not check in as often.

The communication overload finding also represents a culmination of the two other key themes.


**Untapped Potential & Hope for the Future**

These three themes describing the key social media challenges, *incomplete feedback loops, unclear prioritization*, and *communication overload*, led to an overarching finding: interviewees painted a picture of the disaster response as one of *untapped potential*. While the informal individual volunteers and groups rescued thousands of flooded residents, many interviewees expressed regret that they could not rescue more people. Mike, a member of the Cajun

Navy put it succinctly:

> "There was a lot more volunteers could've done, but there just was not enough resources to direct us where we needed to go so what you ended up with was the end of the day was a thousand guys riding around trying to find people to help."

Similarly, Brock commented how the ad hoc nature of the response made some boats redundant:

> "I think that was the hardest part was explaining, okay, if you four boats go in that neighborhood and you three go into that neighborhood rather than 20 of us going to here and there's only three families that need it."

Susan also noted the extra boats:

> "We had so many boats in the neighborhood they actually had to be sent away because there were too many."

Even though they may not have accomplished as much as they would have liked, some expressed amazement at the collective effort. For instance, Harriett acted as a behind the scenes dispatcher using the Zello App and commented:

> "To know how much was done without official organization is just mind boggling to me. That many thousands of volunteers with no official organization or no one really telling them what to do just kind of coming together and making it happen."

## DISCUSSION & CONCLUSIONS

Previous disaster research confirms that individuals and groups have a tendency to become more cohesive, improvisational, and prosocial when faced with disaster (Helsloot & Ruitenberg, 2004; Murthy, 2013; Stallings & Quarantelli, 1985). In other words, people *want* to help. This study provides additional insight into the roles that citizens can play in the rescue effort and what we can learn from how social media was used to coordinate and respond during Hurricane Harvey. While official responders have used a response-dispatch model for decades, official communication channels are private and not accessible to the public. While some privacy is certainly needed, we find that the only way citizen rescuers can share information about rescues with official rescuers is by leveraging the information compiler role.

Furthermore, the separate groups of citizen rescuers have a similar challenge: they use different social media platforms. One of the few shared systems was Zello, and it was not used by all groups. For instance, Jake, a leader of one of the Cajun Navy groups commented, "They'd [rescuers] never heard of Zello or didn't know how to work it, didn't even have the app on their phone, so what I'm getting at is they weren't real tech savvy." But that particular group had their own system they used to coordinate rescues. Figure 4 displays this coordination challenge, but also illustrates how dispersed citizens who want to help can jump into the response process and serve in valuable behind-the-scenes roles.
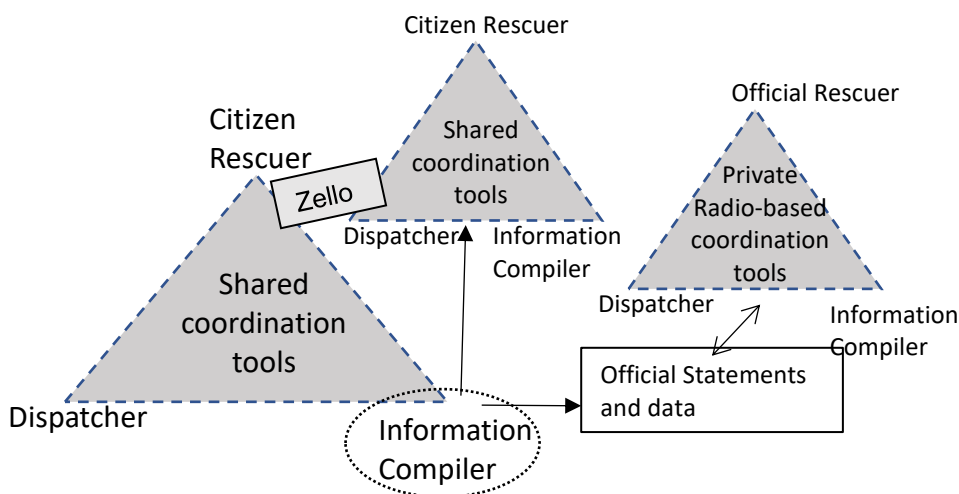


**Figure 4. Information Compiler Role**

Figure 4 is a simplification of what actually occurred during Hurricane Harvey. Our data show that there were at least 20 different groups, and between them, there was no way to seamlessly share information and coordinate activity. The information compilers would often look between the disparate groups and try to share that information to close

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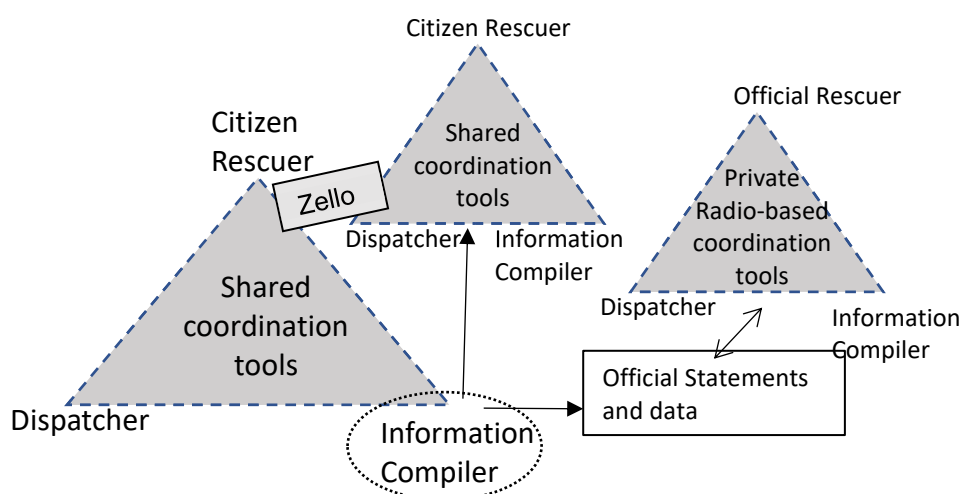


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feedback loops, but they could not do much about prioritization or overload. The dispatchers were often making the decisions on prioritization, but they felt uncomfortable having that much responsibility unless they had been trained in a similar job role prior to the emergent dispatch system.

Communication overload was a challenge faced primarily by the citizen rescuers and dispatchers. As previous research has indicated communication overload encompasses multiple dimensions and can lead to frustration, poor decision making, and burnout (Burchell, 2015; Stephens et al., 2017). Brock, a rescuer with a community group, communicated with his team of other boats using his own 2-way radio system but he also kept an earpiece in his ear tuned to the Zello App; that was how he learned where to go and who needed to be rescued. Brock commented, "by far I think [Zello] was what made the impact because the setting up of that was just incredible. By the time we got there it was all over social media 'get on Zello!'" Zello functioned as a way for disparate groups to share some rescue information, but in the process, so many people jumped on Zello that communication overload became a reality. These are clearly real problems, but Harriett, a dispatcher, still found the social media tools useful: "I do feel like without that app and social media and obviously of course without the volunteer rescuers who were out on the boats I think lots more people would have died."

The challenges facing citizen-led disaster response are not simply technological. While technology designers should take into account affordances of the social media platform (e.g., prioritization, feedback loop) that will help disaster response, attention should be paid to the design of intuitive systems that can quickly be mastered by the novice social media user.

This study is limited by a small number of interviews concerning one specific disaster response. However, we are in the early stages of this 'work in progress' and plan on further developing our findings for future studies. The findings presented here represent an early look at the communication technology challenges and opportunities facing citizen-led disaster response coordination.

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