ABSTRACT
In the aftermath of a traumatic mass casualty event, a community’s resources are strained, while its needs for tangible, emotional, and informational support are elevated. Social media may serve to bridge the distance between the locally affected community and those outside who are willing to offer support. This exploratory study uses Twitter as a lens for examining gratitude for support in the aftermath of disaster. We examine how social media may provide new opportunities for support to be exchanged and networks to be formed in the aftermath of a traumatic event. By analyzing tweets originating from Newtown, CT after the school shooting, we identify and describe six categories of support exchanged through Twitter, including two categories (symbolic and role-based) that have not been extensively discussed in the social support literature—but are valued by the community. Each type of support network shows distinct structural characteristics and temporal variance.

CCS Concepts
• Human-centered computing → Social networks; Social media;

Keywords
social media; Twitter; traumatic mass casualty events; social support; social networks

1. INTRODUCTION
Social support has been demonstrated to be important throughout the life course, whether considering economic, social, psychological, or physiological perspectives, and is particularly valuable as a moderator of life stress [9]. People typically turn to their network of close ties when in need of support, whether that support is a hug, advice on an important decision, or tangible aid in a time of need [48]. However, social media platforms like Twitter have opened new avenues through which individuals can engage in supportive activities, extending the possible network of individuals far beyond an individual’s known network. The affordances of these spaces provide a public broadcasting platform for sharing personal information, as well as for being able to quickly provide support when it is requested [13]. Furthermore, the technical structure of these sites lower the transaction costs associated with these exchanges, whether it is “Liking” a post on Facebook, retweeting information about an event, or posting a few quick words in response to an update. Social media have magnified the potential for sharing information and forming social ties beyond what would have ever been possible before the technology.

Social media also provide individuals with the ability to process and respond to major events, even if they have not been directly affected. In the case of a mass traumatic casualty, such as occurred December 14, 2012 in Newtown, CT, social media quickly became a place for information diffusion and, more importantly, social support provision to those directly affected. In the weeks following the event, Newtown residents struggled to comprehend the event that rocked their community. Many people took to Twitter to express their support and condolences, both within the community and around the world.

The present study examines a large corpus of publicly available tweets sent by people living in Fairfield County, CT over the month following the Newtown shooting to identify and categorize supportive interactions with members of the community. From coding a set of approximately 2000 tweets that explicitly expressed gratitude for some form of support, we identified six unique types of support exchanged in the aftermath of the tragedy. We then analyzed network-based and temporal characteristics of these tweets. The results provide new insights into the potential positive impact that
2. RELATED WORK

2.1 Social Support and Resource Provision in Local Communities

Social support underpins the success - or failure - of communities and impacts the well-being of individual community members. At the individual level, Shumaker and colleagues define social support as “an exchange of resources between two individuals perceived by the provider or the recipient to be intended to enhance the well-being of the recipient” [37] (p. 11). Communities characterized by high levels of trust and reciprocal support between members are generally more efficient than more distrustful communities [34]; frequent interaction with and trust of neighbors makes it more likely that individuals will contribute to the betterment of the community. Likewise, Lin [28] notes that resources embedded in the community may enhance individual and community outcomes by facilitating the flow of information (e.g., about opportunities), providing support (e.g., making dinner for a sick neighbor), and reinforcing members’ identity and recognition as a part of a larger group.

Weiss [48] has noted that individuals’ perceived well-being is largely dependent on the availability of social support resources from their networks. When one does not believe they have people to turn to within their social network, they are more prone to depression and feelings of social isolation [10]. In his seminal work on social provisions, Weiss identified six types of support provisions - attachment, social integration, opportunity for nurturance, reassurance of worth, reliable alliance, and guidance, and argued that provisions of support are largely based on the relationship between two people. For example, female friends are likely to provide attachment resources, whereas one might go to a very close, trusted friend or family member for guidance. Typically, research examining social support has found that the majority of support, and especially emotional support, comes from close ties - one’s inner circle of friends and family [21, 48, 49]. Additional research on community networks found that neighbors provide a significant portion of emotional and tangible support, as well as companionship [49].

2.2 Social Media’s Affordances and Mediated Support Provision

Social media contain numerous affordances that differentiate them from other forms of communication and span gaps between individuals and groups that would have been difficult to connect without the technology. Treem and Leonardi [42] describe four affordances, including the high visibility and persistence of content, the ability for users to edit content before and after posting, and the (often) visible connections between users (e.g., via Following/Followers on Twitter) and content (e.g., a user’s name is associated with shared content). Ellison and Vitak [15] also highlight the broadcasting aspect of many social media platforms, which allows users to quickly disseminate content to a large and diverse audience - that content may then be retweeted or shared, which exposes the original post to a much wider audience.

Social media enable users to both request and provide a wide variety of types of support. Studying online forums, Braithwaite and colleagues identified five types of support exchanged through the system, including information support, tangible assistance, esteem support, network support, and emotional support [5]. Findings from a recent study suggest that social media’s affordances facilitate the provision of emotional and instrumental resources across a wide range of network ties, and especially weaker ties, who are less likely to provide support in more traditional settings [44]. Recent work by Ellison and colleagues has found that people who requested resources through Facebook reported higher levels of perceived access to support and were more likely to respond to resource requests from Facebook Friends [14]. Additionally, engaging in supportive activities, such as responding to a Friend’s question or offering support for good or bad news shared via the site, positively predicted users’ perceived bridging social capital [15]. They term these supportive behaviors “Signals of Relational Investment” (SRI) to indicate the maintenance function they serve. This behaviors are unique in that they more highly visible than similar interactions occurring offline.

Recent work has examined the role of Facebook in terms of the affordances it offers for social support, independent of the existing social networks of users, and finds use of social media may facilitate access to resources [31].

2.3 Community Response to Tragedies

To ground our understanding of social media as a lens in the context of disaster and community-level traumatic events, we consider prior work on disasters more broadly. How communities cope with social crises and disasters has been studied for decades across numerous disciplines, including social psychology, organization theory, public policy, and emergency management [35]. Following a large-scale tragedy, community members are likely to feel symptoms associated with acute stress. Kaniasty and Norris [26] observe disruption of social networks through death, injury, or relocation, needs for actual support exceeding availability, decline in the level of routine daily activities, a decrease in social participation (community members putting social life “on hold”), and interpersonal weariness, as well as the potential for increases in interpersonal conflicts, and stresses associated with challenges to societal and political status quo.

In his discussion of community response to tragedies, Walsh [46] argues for a resilience-oriented approach to facilitate the healing process. Key processes he describes include: (1) connectedness, or providing the reassurance and emotional support individuals need in the immediate aftermath; (2) mobilizing local and extended networks of institutions and families to provide assistance; (3) clear, consistent information about what has happened and what is being done; and (4) a space to share oneâ€™s grief with others.

2.4 Social Media and Support Provision Following a Tragedy or Disaster

Spontaneous, unofficial efforts to help seem to be a hallmark of human response to tragedy. With the rise of social media, online activities consistent with this phenomenon are appearing [24], and will be shaped by the affordances of social media [29, 38]. Particularly when an impending disaster can be predicted, local populations may assist with preparations for the event and help prevent or minimize damage. After an event, they can use social media to share information and coordinate recovery activities [39, 43, 40, 17].
The Newtown school shooting can clearly be considered a major negative life event – a type of stressor type which is “well-established...to predict subsequent physical morbidity, mortality, symptoms of psychological distress, and psychiatric disorder” [41]. The nature and scale of this tragedy, combined with its high visibility on social media, make the events at Newtown a highly salient case for studying social media-facilitated support provision.

4. DATA AND METHOD

We examined Twitter data from Fairfield County, Connecticut (where Newtown and Sandy Hook are located) over 32 days, from December 14, 2012 until January 14, 2013. We gathered user content from Twitter for Fairfield County, Connecticut using Twitter’s Search API. We collected tweets sent from a location in Fairfield County, producing 320,000 tweets over the period. The Twitter Search API returns tweets that have a latitude and longitude within the queried geocode, and additionally returns tweets created by users whose profile location can be reverse geocoded into a lat/long within the queried geocode. This means that it is possible to receive tweets that did not include lat/long information. We also queried directly on the users from Fairfield County whose tweets were returned by the Twitter API, to retrieve any potential additional tweets from these users during the timeframe.

For this project, we were guided by the question of how social media platforms like Twitter are used in the aftermath of a large-scale tragedy. Previous work with this dataset has analyzed death-related talk from Fairfield County and a comparable county, revealing striking differences in the magnitude and duration of increases in death-related talk between these communities. It also detects subtle shifts in the nature of death-related talk, with increasing literal discussion of death, and decreased figurative mentions of death.

The current work evaluates the potential for social media to facilitate support provision both within the community and from people around the world. The severity of this shooting brought a national and international focus to Newtown, and social media enabled those not directly affected by the tragedy to provide support and resources to the community. Our results offer lessons for gauging public response and for developing interventions in the wake of a tragedy.

To evaluate instances of support provision, we first began identifying tweets referencing supportive acts. We observed that tweets acknowledging support may do so in one of two ways:

1. **Explicitly**, as when someone directly thanks another user for kind words or a supportive gesture in the tweet text (e.g., @A @B Thank you for the kind words and support for the Newtown community during this difficult time); or

2. **Implicitly**, by embedding a link to additional information or images characterizing the support, such as a photograph of a memorial for the murdered children.

Machine learning approaches applied to this corpus with the intent to automatically identify tweets relating to support provision generally - while sufficiently accurate for overall corpus characterization [19] – produced too many false negatives to be optimal as a basis for network analysis. Instead, a simple approach of examining tweets for terms re-
lating to thanks, gratitude, or appreciation produced superior recall (.93 vs. .65 recall, based on test data used for the machine learning model). Since English has a relatively small vocabulary for expressing thanks, and those expressing thanks would seem motivated to do so in a clear fashion, this was effective. We queried the corpus for tweets containing terms relating to thanks or gratitude and identified 1996 tweets.

Next, we randomly sampled 350 tweets from those identified to determine if they included supportive content related to the event and to categorize the various types of support exchanges. Using previous research on support types as guidance [23, 11, 5], the first two authors began coding the data with three types of support in mind: (1) emotional or nurturant support, which could include expressions of sympathy or hugs; (2) tangible support, ranging from providing monetary support to making meals for families; and (3) informational support, including disseminating updates or sharing links to other resources. Tweets were excluded if they were unrelated to the shooting, if they were sarcastic in nature (e.g., “thanking” the NRA for pointing out that they are the “true victims” of the school shooting tragedy), or if there was insufficient context to be assigned a type. While most tweets referenced only one type of support, multiple codes were applied when warranted.

Through this process, we identified numerous expressions of event-related support in Twitter data from the community, including the three types of support highlighted in previous literature, as well as three additional types of support largely facilitated by Twitter’s affordances. Members of the Newtown community frequently thanked others for gestures of symbolic support, such as organizations holding a moment of silence or sending cards. They also acknowledged others, such as teachers, first responders, and President Obama for performing their roles exceptionally well under such extreme conditions. Finally, community members expressed a more generalized appreciation or gratitude, a reflective act of thanks directed toward a higher power for some aspect of the outcome of the tragedy, such as the safety of loved ones who were in harm’s way. See Table 1 for a description of each of the six types of support and examples from the dataset.

The first two authors met following the initial round of coding and finalized the coding schema. They then each coded half the remaining tweets based on this taxonomy and met again to discuss questionable cases. Finally, they each coded the other half of tweets, met, and discussed the small number of cases (<5%) that had discrepant coding. In a number of cases, the raw text of the tweet provided insufficient context for annotation. Recovering additional tweets belonging to the discourse sequence, or examining references in the tweet, such as links to photos of memorials or poems, usually filled that gap and enabled annotation. In the end, 1184 specific expressions of event-related support were identified from those tweets identified as referring to thanks.

We have examined each support type as a network of actors who have provided or acknowledged support. We further characterized the nature of the interactive tie from the user who tweeted to any others referenced in the tweet, based on affordances and conventions of usage within Twitter (see Figure 1). Within tweets, we analyzed the following types of interactions:

- Addressal: a tweet that is explicitly directed at another, comparable to directly talking to another in public
- Direct mention (DM): explicitly naming another in the content of a tweet, without having directed the tweet at that other, comparable to talking about another in public
- Retweet (RT): rebroadcasting the tweet of another, comparable to quoting another in public
- Indirect mention (IM): mention of another that is embedded in the body of a retweet
- Self: a tweet that does not mention another user (represented as a self-loop in the figure)

![Figure 1: Frequency of six types of social network support acknowledgment following Newtown shooting. Nurturant support is most frequently observed](image)

<table>
<thead>
<tr>
<th>Support Type</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addressal</td>
<td>600</td>
</tr>
<tr>
<td>DirectMention</td>
<td>500</td>
</tr>
<tr>
<td>IndirectMention</td>
<td>400</td>
</tr>
<tr>
<td>Retweet</td>
<td>300</td>
</tr>
<tr>
<td>Self</td>
<td>200</td>
</tr>
<tr>
<td>Others</td>
<td>100</td>
</tr>
</tbody>
</table>

We used software that extracts all user mentions and determines the interaction type relative to the tweet sender from the tweet JSON. While both tweeting and retweeting are deliberate, public actions by individuals that create ties with others, tweets that address or directly mention another may serve as stronger signals of relationship investment [15].

5. FINDINGS: EXPRESSIONS OF SOCIAL SUPPORT

Within the corpus of tweets expressing support in Fairfield County, we observed nearly 800 unique Twitter users. Users who tweeted to acknowledge support during the event did so directly in 60% of cases, while retweets of others’ expressions of gratitude constitute only 20% of activity. Different types of support were seen with different frequencies. Each type of support network will be discussed in more detail in the following sections. For each network visualization, line color indicates interaction type: Orange=Addressal, Blue=Direct mention, Green=Indirect mention, Cyan=Retweet, and Gray = Self.
Table 1: Types of support provided and acknowledged in social media after the Newtown school shootings.

<table>
<thead>
<tr>
<th>Type of Support</th>
<th>Definition for Coding</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumstance-gratitude</td>
<td>Reflective comments. May be directed towards a higher power or the universe. Expressing gratitude for safety of friends, family, or self, or that some frightening aspect of the tragedy is over, to have known one of victims, or for some other aspect of one’s circumstance.</td>
<td>Thank you God ... finally heard from a friend who’s daughter attends Sandy Hook Elementary; she's okay!! #PrayForNewtown</td>
</tr>
<tr>
<td>Information</td>
<td>Support expressed by sharing information, news, stories or updates.</td>
<td>@C the voice of Newtown.. Thanks for keeping us all updated buddy!!</td>
</tr>
<tr>
<td>Nurturant</td>
<td>Support provided by uttering kind words or prayers, or other forms of emotional support or comfort.</td>
<td>@D - Thank you, D. Yours and everyone's words of support mean so much to us all.</td>
</tr>
<tr>
<td>Role</td>
<td>Support provided by those holding roles in society, such as principals, teachers, first responders, the mayor, therapists, police, etc., for service above and beyond expectations.</td>
<td>RT @E: Thank you, educators, for facing your own fears today and helping students and parents cope with tragedy and return to l ...</td>
</tr>
<tr>
<td>Symbolic</td>
<td>Support expressed by actions that don’t meet a physical need or directly provide emotional comfort, but symbolically honor or respect victims or the community, such as wearing an armband or holding a moment of silence.</td>
<td>for anyone who wears green and white on mon ...</td>
</tr>
<tr>
<td>Tangible</td>
<td>Support expressed by taking action, providing physical resources (money, food, etc.), or any other type of donation, or participation in charitable or fundraising efforts.</td>
<td>#SantasforSandyHook has raised close to $20,000 for their efforts for the families! THANK YOU! #WeAreNewtown</td>
</tr>
</tbody>
</table>

5.1 Circumstance-gratitude

This is the smallest, most fragmented of all support networks, including just 51 members. Consistent with the reflective nature of this type of support, most community members are in isolated components in the network, or are simply echoing (retweeting) another user.

- Thank God my moms friend is okay and her son. #praysfornewtown
- RT @R: Thankful that @S was my dear friend and colleague. So very sad that she is gone. Be strong, Newtown

5.2 Information

His network is intermediate in size and displays a richer structure than the previously described support network. It contains twice as many users, with nearly half connected in the largest component. Users directly acknowledge the provision of information support, with the majority of network ties explicitly addressing others, while self-ties are nearly non-existent:

1. @F @G Awesome piece in today’s paper on the first responders and others who were there. Thanks to all.

2. Thanks J! Spreading the word definitely helps! Feel free to use the photo from the previous tweet

5.3 Nurturant

Community reeling from shock, grief, and loss, it is hardly surprising that nurturant support ties are observed more frequently than any other type. Responses to kind, emotionally comforting words and gestures of support generate a network of 526 users, with over 80 percent in the main component. This network is dominated by the tie type of addressal, a clear signal of relational investment in those who provide emotional comfort in difficult times. This is a representative example of such a tweet:

- F i know. thank you, a lot of people are making me feel better by just sending condolences. it's hard, but we're #203strong

While some actors are highly central in this network, over 40 actors have nurturant ties with at least four others.

5.4 Role

The perceived social support provided by others performing their roles with exceptional grace and competence in extreme circumstances has not been detailed in the literature. In the case of the school shootings at Sandy Hook Elementary School, this type of support is observed with respect to roles including school and local officials, first responders, and national-level officials. The network of role-based social support is moderate in size and connectivity. It contains 99 actors, with 70 in the main component. Only 6 actors are isolates, generically thanking others for their role-based support. Far more ties in this network are retweets, indicating that amplification or repetition of well-stated praise for a role-holder is an accepted behavior.

1. RT @G: Spectacular speech by President Obama in
Figure 3: Network of symbolic support. This support network reflects those who have provided symbolic support (e.g., wearing school colors, creating memorials).

Newtown. He spoke eloquently as a father and a leader. Thank you, Mr. President.

2. @K: Hiding students inside cabinets? Omg .... Thank you teachers for trying your best

5.5 Symbolic

Symbolic support, unlike food, shelter, or money, meets no tangible, physical need. Yet it mattered to the community, as evidenced by the size of the network. There are 159 actors represented in the symbolic support network, with over 70 percent in the main component. Respectful gestures, whether from celebrities or children hundreds of miles away, had meaning and significance for the community. This may reflect the role that such symbolic acts can play in alleviating the potential for unacknowledged or disenfranchised grief [32]. Such displays may serve as proxies for social solidarity after mass trauma [22]. Both directly addressing others, and acknowledging symbolic support by retweeting are comparably prominent in this network. The first example below is a reference to symbolic acts by famous individuals, while the others reflect support at the state or local level.

1. Thank you @K and @L for honoring and remembering the tragedy at my town and my mom’s work place S.H.E.S.

2. 40 other states observed #momentofsilence thank you. Words still fail us, silence says more. #newtown #sandy-hook

3. RT @M: Thanks @N for sharing this great poem from students in Fairfield, Conn. http://t.co/efgh

Additional symbolic acts of support included the creation of signs, memorials, and other works of art, authoring or composing tributes, and wearing or decorating clothing to show respect for those lost in the tragedy.

5.6 Tangible

Perhaps surprisingly, given the concrete nature of tangible support, this network is most similar in size and structure to the symbolic support network. Containing 204 actors, with over 80 percent in the main component, this network also features a nearly equal propensity towards directly addressing others, to personally acknowledge their generosity in providing tangible support, and retweeting, or publicly amplifying the credit others receive for their generous acts. There are very few isolates in this network. The following are representative tweets describing tangible support:

1. @H @I Thank you! Your help will allow us to push forward and create a scholarship for many years to come!!

6. FINDINGS: TEMPORAL ANALYSIS

We also examined temporal patterns of support-related tweeting in detail. To our knowledge, data with this degree of temporal granularity has not been examined with respect to social support provision in the aftermath of a traumatic mass casualty event. We based the key temporal features considered on prior work examining social networks and hashtag usage in the context of the London riots of 2011 [18].

Based on the number of tweets for each type of support seen on each day, we observed distinct temporal patterns for each type of support. Nurturant support spiked immediately after the event, reached its peak on the second day, then began to diminish. Half of all nurturant support tweets had occurred by the third day (half-life day). However, nurturant support continued to occur throughout the time window, and was observed on all but one of the 32 days. This is in line with literature on support following tragedies, in that emotional support is most critical in the immediate aftermath of the event, but is important in long-term healing and resilience [46]. Circumstance-gratitude also peaked early, but quickly faded. After the 4th day, there was a 3-day lull with no tweets indicative of this type of support. It is only sporadically observed, appearing on 8 of the 32 days overall.

Both tangible and information support show the pattern of peaking very late, on the final day. This is likely due to observation of the one-month anniversary of the shooting. However, both are common throughout the timeframe, occurring on at least 75% of days. Tangible support differs in that its half-life occurs a week after information support, near the midpoint of the time window. This may indicate the time needed to organize and deliver tangible support, and its existence as a sustained activity, whereas information support is driven by externalities, such as new knowledge that is learned or new events to report on. Reflections on the
anniversary of the killings may motivate both commentary and acts of giving.

The two other new types of support identified in this work, symbolic and role support, shared temporal similarities. Both peak early, on the third day, and achieve half of their total activity in the first week following the event. Symbolic support is a more constant phenomenon, occurring on 24 of 32 days.

An uptick in all types of support was seen on 14 January. As signals of relationship investment, tweets acknowledging social support given and acknowledged became more frequent on the one-month anniversary of the tragedy, a symbolic temporal marker for the event. We have described temporal differences between different types of support networks. Delving deeper into the behavioral aspects of the ties to others, signals of relationship investment, we also compared these networks more specifically.

Social support in the aftermath of a collective mass traumatic event is clearly not a uni-dimensional phenomenon. We found evidence of multiple types of social support acknowledged in Twitter, with each type of support possessing unique temporal and network properties. Considering both the behavioral aspects of the ties to others (RTs, direct mentions, etc.), and the temporal aspect of when these signals of relationship investment were expressed, we compared these types of support more specifically. While both nurturant and circumstance-gratitude possess a clear emotional component, the two were not correlated (Pearson’s $\rho = 0.01$, $p=\text{n.s.}$). The most concrete types of support, information and tangible, showed a relatively small but statistically significant positive correlation (Pearson’s $\rho = 0.28$, $p < .001$). The most abstract types of support - symbolic and role - were moderately correlated ($(Pearson’s \rho = 0.43$, $p < .001)$).

7. DISCUSSION

By analyzing social media-facilitated supportive exchanges following a traumatic event, we can begin to unpack the potential these ICTs have in providing various forms of assistance in times of need. Much as Twitter helped organize distribution of medics and supplies following the earthquake in Haiti [36], the site allowed people to provide nurturing, informational, symbolic, and tangible forms of support to the residents of Newtown. This is highlighted in a tweet by a Newtown resident during a fundraising campaign:

The power of social media has swarms of people coming to purchase shirts.

The affordances of social media [42] played a critical role in the response to Newtown. The high visibility of these events, paired with the ability to widely disseminate requests for support, suggest that social media platforms can extend support provisions far beyond the time they would have without the technology. This allows more stories to be shared and more support to be received, which may be helpful during the healing process.

Beyond temporal components of support provision, social media also remove geographic constraints that may have otherwise limited support options. While the Newtown shootings received national coverage in the media, the event itself was highly localized, in a small suburban community in Connecticut. As Twitter provides a public forum and facilitates the dissemination of content through various features like hashtags and RTs, individuals could both solicit and provide support through the site, or use the site to facilitate supportive actions offline. In this way, people who were not directly affected by the tragedy could participate in symbolic and tangible ways. An example of this is the CMAK Foundation, created by the affected families to raise awareness and money to support the affected families. Still active today, the foundation used Twitter and Facebook to share information, and the content it shared created a more tangible link between the abstractness of “people being killed somewhere far away” and the reality of a first grader who loved to play baseball not growing up.

The family’s willingness to share information about their son likely resonated with more people than informational reports because of the emotional connection between parents and children. Likewise, sharing personal accounts of the victims helps establish common ground between outsiders and those affected and establish bridging social capital by making people feel like they are part of a broader community. In the case of one child who loved the New York Giants, a tweet led to one player honoring the child with hand-written notes on his shoes at the following week’s game. Both the New York Giants and the New York Jets engaged in additional symbolic gestures to honor the victims [6].

The power of social media in response to a crisis lays in the visibility and persistence of the content. Social media did not facilitate the actual provisions of symbolic support; rather, it created connections between people and enabled people outside the community to share their actions with those inside. Likewise, when we consider one of the most widespread tangible forms of support resulting from tweets – the “26 acts of kindness” hashtag Today Show host Ann Curry began with her tweet, “Imagine if we all committed 20 acts of kindness to honor the lost children of Newtown.” Social media provided an additional way for people to show their support and to encourage others to participate as well. In this above case, Ann Curry’s role as an influencer – a trustworthy person with a large online network – helped jumpstart a wave of altruistic acts around the country. Opinion leaders play a powerful role in influencing both what is discussed and the shape of the conversation [7]. On Twitter, these people include celebrities, news organizations, and the President. At a local level, however, people serve very important roles in their community, and Twitter provided an outlet for Newtown residents to thank all those who went above and beyond the call of duty, including the teachers and principal of Sandy Hook Elementary, as well as a number of other local administrators. These opportunities can strengthen community bonds, which will in turn help residents to heal.

The patterns and structures that emerge from a network-level view of types of support networks suggest people are sensitive to subtle distinctions in the acts of acknowledgement they publicly make. Emotional support, arguably the most intimate type of support provided, received the highest proportion of the most direct and personal response, i.e., tweets directed at the provider of support. Conversely, retweets were proportionally the most rare interaction type for emotional support, which may be indicative of some social compunction against publicly amplifying these personal expressions. For role and symbolic networks, this pattern was reversed. Publicly crediting the acts of others via retweeting was prevalent. The paucity of reciprocated (bi-directional) ties across all support networks may reflect the inherent asymmetry of support, in that those in need of
support may not have the capacity to reciprocate, and the providers may themselves not be as deeply in need. It is also potentially a reflection of the data collection strategy. By focusing on the behavior of the community, of those user accounts from within Fairfield County, we could miss support acknowledgments from outside those boundaries. For this reason, we do not attempt analyses that would be sensitive to this bias (e.g., triad census, cliques).

Finally, by looking at the evolution of support over time, it becomes clear that different types of support were being provided at different points in time. To some degree, the findings in this dataset contradict research on offline support provision, which notes that nurturing support is most important in the long term, whereas more tangible support is needed in the immediate aftermath [25]. The reason for this finding in the Twitter dataset is likely due in large part to geography: social media enabled a tremendous outpouring of nurturant support immediately following news of the shooting because messages are distributed publicly online. Tangible forms of support such as providing food and shelter can only be facilitated in person, so people must rely on their community for those resources. However, other forms of tangible support, including donations, are widely accrued through social media in the weeks, months, and years following such events, as systems to support electronic exchanges are deployed. For example, researchers identified a significant correlation between tweets about the Haiti earthquake in 2010 and donations to organizations like the Red Cross [30]. For Newtown, local charities and events saw a large spike in donations from outside the community because messages could be widely disseminated.

8. CONCLUSION

Twitter data from the aftermath of Newtown provides important insights into how communities deal with tragedies in the first month following the event. There are a number of important implications from this research and directions for future researchers to take when considering similar questions to those addressed here. Research indicates that people affected by tragedy fare better when they have larger support networks, both in the immediate aftermath (through provisions of more tangible forms of support) [27] and in the long-term (through more nurturant forms of support that mitigate negative psychological symptoms) [25].

One question for future researchers will be to determine whether strong online support networks may help fill the gap when one has a smaller support network where they are located. The tremendous outpouring of support through social media platforms like Twitter and Facebook following the Newtown shooting, and the genuine appreciativeness community members expressed back, suggest there is significant potential in these spaces. On Facebook, research has already suggested that even small signals of support have a positive impact on feelings of support and access to resources [15, 45], but how does this apply when we consider much larger, heterogeneous networks of people offering to help? More broadly, researchers should consider how social media can be used to provide supportive resources like counseling for victims or to identify people who may need support. Note that this work is already beginning with predicting depression via social media, see [8].

Large datasets such as the one discussed in this paper also raise important questions about the ethics of data collection and analysis through social media scraping techniques. This becomes even more important when dealing with sensitive topics, such as a community shooting. Beyond ensuring privacy protections to those whose data are collected, another important question relates to how data are selected and how those choices might influence results. One limitation of this study is that the researchers chose a limited selection method that likely missed a number of subtle or implicit references to support (i.e., those not using the word “thank” or variations). The data were also limited to tweets originating from Fairfield County, which is not very problematic in identifying instances where people recognize support from others, but excludes supportive messages from those living outside the county. How does this narrow frame of reference affect the findings? Researchers must continue to consider the ethics of big data use and develop stronger methods for sorting data and either consenting participants or ensuring that the data and the sources of the data cannot be merged. In this paper, we have taken steps to ensure that enough content has been removed from sample tweets to prevent someone from finding the source of the tweet through a Google search.

Finally, the response to Newtown raises new questions about the potential for social media to facilitate political change. Results of this study suggest that this may be highly context dependent. A few days after the shooting, President Obama gave an impassioned speech about the need to change gun laws, and the speech received a lot of support on social media and elsewhere. However, legislation stalled in Congress and comprehensive gun reform has still not passed two years later. In light of this, it is important to recognize both the potential and the limitations of social media, and to conduct research that works to establish those boundaries.

9. REFERENCES


| Table 2: Summary of Key Temporal Features for all Support Types |
|-------------------|-----------------|-----------------|-------------------|-----------------|-------------------|
|                  | Peak day | Half-life day | Days til 2-day lull | Days til 3-day lull | Total days with activity |
| Circumstance-gratitude | 3        | 3              | 4                  | 4                | 8                  |
| Information       | 32       | 9              | 19                 | NA               | 24                 |
| Nurturant         | 2        | 3              | NA                 | NA               | 31                 |
| Role              | 3        | 5              | 13                 | 13               | 18                 |
| Symbolic          | 3        | 7              | 13                 | 13               | 24                 |
| Tangible          | 32       | 13             | 16                 | NA               | 30                 |


[36] A. Sarcevic, L. Palen, J. White, K. Starbird,


